

ESSENTIAL



Mathematics

Basic 9

Facilitator's Guide



CAMBRIDGE



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INTRODUCTION

The aim of the Junior High School Mathematics Common Core Programme curriculum is to provide learners with opportunities to further their Mathematical knowledge and skills and ensure they develop the attitudes and dispositions required to be successful Mathematics learners.

The revised Mathematics curriculum is standards-based Common Core Programme that seeks to equip learners with the requisite skills needed to do Mathematics in ways that is enjoyable and easy. The curriculum drives on the development of conceptual understanding, critical thinking skills and problem-solving abilities and capabilities. The Facilitator's Guide with its accompanying Learners' Book offers full coverage of the 2020 Common Core Programme Mathematics curriculum for Junior High Schools with a problem-solving and inquiry-based approach to the learning of Mathematics.

Each lesson is based on a big idea that provides an engaging, exciting theme that is endorsed in a real-life context. The big ideas are meticulously presented using the scaffolding and differentiated strategies to accommodate diverse learners in the Ghanaian classroom. Activities, exercises and investigations provide opportunities for learners to apply their knowledge, skills and understanding of the Mathematics they are learning. The series also offers additional teaching and learning resources and mental maths games to support teaching and extend learning.

This material supports teachers in planning and delivering successful Mathematics lessons. It provides a clear understanding of learners' pre-requisite skills using Starter activities before introducing new concepts. Through its reinforcement activities in the form of "Starters", regular revisiting and extending previous learning is emphasised to ensure better understanding of concepts before new ones are introduced.

The curriculum is organised under Strands, Sub-strands, Content standards, Indicators and exemplars.

- **Strands** are the broad areas/sections of the Mathematics curriculum to be studied.
- **Sub-strands** are larger groups of related indicators. Indicators from sub-strands may sometimes be closely related.
- **Content standards** refer to the predetermined level of knowledge, skill and/or attitude that a learner attains by a set stage of education.
- **Indicators** give a clear outcome or milestone that learners have to exhibit in each year to meet the content standard expectation. The indicators represent the minimum expected standard in a year.
- **Exemplars** refer to support and guidance that clearly explain the expected outcomes of an indicator and suggest what teaching and learning activities could take to support the facilitators or teachers in the delivery of the curriculum.

This Facilitator's Guide and its accompanying Learner's Book are organised under four strands and twelve sub-strands:

- **Strand 1: Number**
 - Sub-strand 1: Number and numeration systems
 - Sub-strand 2: Numbers operations
 - Sub-strand 3: Fractions, decimals and percentages
 - Sub-strand 4: Number: ratios and proportion

- **Strand 2: Algebra**
 - Sub-strand 1: Patterns and relations
 - Sub-strand 2: Algebraic expressions
 - Sub-strand 3: Variables and equations
- **Strand 3: Geometry and measurement**
 - Sub-strand 1: Shape and space
 - Sub-strand 2: Measurement
 - Sub-strand 3: Position and transformation
- **Strand 4: Handling data**
 - Sub-strand 1: Data
 - Sub-strand 2: Chance or probability

Learning areas (strands)

Strand 1: Number

An understanding of number extends beyond mere recognition of number and operations. Learners are required to develop a conceptual understanding of numbers. That is, they understand the value of each number and can describe the relationship between numbers. Learners should be able to solve everyday problems with their number sense.

The conceptual understanding of number operations goes well beyond memorising basic facts and the steps to follow when adding, subtracting, multiplying or dividing numbers or fractions. It involves combining both the procedural and conceptual understanding to demonstrate what it means to add, subtract, multiply and divide, and the effect that these operations have on numbers.

Again, an important requirement of the standards-based curriculum involves encouraging learners to develop personal strategies that are accurate and flexible. Developing personal strategies for adding, subtracting, multiplying and dividing as well as developing a variety of strategies for computing mentally (without pencil and paper) and for making reasonable mental estimations is an important requirement by the curriculum.

Further, this strand emphasises the development of the conceptual understanding of ratios and proportions. Learning ratios and proportions is crucial as they form the basis for advanced math, support real-life tasks such as cooking and shopping, enhance problem-solving skills, and are essential in science, engineering, finance and medicine. Mastery of these concepts improves numeracy, as it enables informed decisions and practical problem-solving in various aspects of life.

Strand 2: Algebra

Mathematics is often regarded as the science of patterns. When solving complex problems, we frequently suggest to learners that they try simpler versions, observe specific cases, look for a pattern, and use it to solve the original problem. Algebra involves recognizing, describing, and working with patterns. The standards-based curriculum requires Basic 7, 8, and 9 learners to recognise and describe relationships, extend given patterns, and create patterns. This includes exploring repeating visual, shape, action, and number patterns in pairs or groups. Pattern-based thinking is a powerful tool for solving mathematical problems and understanding new concepts. Major principles of Algebra emerge as generalizations

of patterns in number and shape. As learners progress, they use their understanding of patterns to describe relationships among numbers. This Facilitator's Guide helps Mathematics teachers guide learners in recognising, generalising, and using patterns in numbers, shapes, and the world around them. Learners with these skills are better problem-solvers, understand the uses of mathematics better, and are better prepared for algebraic functions as they move to higher grade levels.

Strand 3: Geometry and measurement

The standards-based curriculum requires learners to understand three-dimensional (3D) objects and two-dimensional (2D) shapes in their environment and classrooms. This includes recognising distinguishing features and measurable attributes of different shapes and objects, and building personal referents for standard measures of length, mass, capacity, area and volume for estimation. This Facilitator's Guide helps teachers employ a broad array of tasks based on learning trajectories, nurture visual cognition towards analytical thinking, and integrate rich and diverse math communication.

Strand 4: Handling data

Mathematics involves describing and explaining relationships, including those in data, symbolically, orally, or in written form. In JHS, learners develop these skills by collecting, interpreting, and presenting data, and making decisions based on their findings. This Facilitator's Guide addresses the crucial concepts involved in data collection and use in the JHS classroom and supports teaching the mathematics of data. It helps teachers convey the underlying concepts learners need to understand to utilise data effectively, comprehend the questions they seek to answer, represent data accurately and interpret it meaningfully.

Assessment

Assessment is a process of collecting and evaluating information about learners' mathematical skills and using the information to make decisions to improve their learning. In this curriculum, we suggested that teachers use assessment to promote learning. Its purpose is to identify the strengths and weaknesses of learners to enable teachers to ascertain their learner's response to instruction.

Assessment in the curriculum includes both formative and summative methods.

Formative assessment: This refers to different methods teachers use to evaluate learners' comprehension, learning needs and academic progress during lessons, units or courses. Formative assessments help identify learners' struggles and address these challenges.

Assessment for, as, and of learning:

- **Assessment as learning:** Engages learners to reflect on their learning expectations. Information from learners helps refine teaching strategies, encourages learners to take responsibility for their own learning, set goals and monitor their progress.
- **Assessment for learning:** Monitors learners' progress and achievement throughout the learning process. Teachers use it to seek and interpret evidence, provide timely feedback to improve teaching strategies and learners' performance, involve learners actively and help them become confident in their learning.

- **Assessment of learning:** This is summative assessment, evaluating learners' cumulative progress and achievement over time, indicating what they know and can do.

As part of the new standards-based curriculum, several core values are to be instilled in learners through their engagement with Mathematics. Different learning activities are designed to develop these core competencies effectively. Group and pair activities foster team spirit and communication skills, while suggested resources enhance digital literacy. The six core competencies for all Ghanaian learners are:

1. **Critical thinking and problem solving (CP):** This competency promotes self-directed thinking, generating innovative ideas, critically reflecting on learning experiences and making effective decisions. The series encourages learners to analyse situations and choose the best solutions from multiple options.
2. **Creativity and innovation (CI):** This competency fosters entrepreneurial thinking, the pursuit of novel ideas and curiosity. The series provides opportunities for learners to develop unique and effective problem-solving strategies.
3. **Communication and collaboration (CC):** This competency enhances skills in using language, symbols and texts to share information and experiences. Learners engage in dialogue, respect others' views and communicate mathematical ideas to expand and clarify their understanding. Lessons include opportunities for learners to discuss, explain, and justify their thinking using oral, visual and written forms.
4. **Cultural identity and global citizenship (CG):** This competency develops globally aware citizens with the skills and knowledge to address sustainability issues. It promotes understanding Ghanaian values and identity through local examples and resources, fostering appreciation for Ghanaian culture.
5. **Personal development and leadership (PL):** This competency focuses on self-awareness, self-esteem, talent development and leadership skills. It emphasises values such as honesty and empathy, helping learners develop skills for lifelong learning and the ability to support others through group work and presentations.
6. **Digital literacy (DL):** This competency enables learners to use information and communications technology (ICT) to support their learning, communicate effectively, and use digital media responsibly. The series provides opportunities to integrate ICT tools into Mathematics learning.

Key features of “Essential Mathematics features”

Comprehensive curriculum coverage: This guide covers the essential topics in the Common Core Programme Mathematics Curriculum for Junior High Schools in Ghana, from concepts of numbers to algebra, geometry, measurement and data. It provides a clear roadmap for structuring lessons to ensure a well-rounded mathematics learning for learners.

Pedagogical and assessment strategies: The guide offers mathematics the opportunity to discover innovative teaching and assessment approaches that make mathematics come alive in their classrooms. Explore ways to create a nurturing and inclusive learning environment where every learner feels empowered to participate and excel. Besides, it helps teachers to tailor their teaching methods based on the insights gained from ongoing assessment, enabling them to provide targeted support to their learners.

Differentiation: The guide creates the avenue to recognise the diverse needs of learners and gain insights into how to differentiate instruction to accommodate different learning styles and abilities. This guide offers practical tips for reaching every learner effectively.

Technology integration: This guide will help teachers embrace the digital age and leverage technology to enhance their Mathematics instruction. It suggests teaching and learning activities that infuse technological tools and resources and methods to incorporate these aids to engage learners and promote deeper understanding.

Real-world applications: This guide shows teachers how to show their learners the real-world relevance of Mathematics by incorporating practical examples and projects that resonate with learners’ everyday experiences, foster their problem-solving skills and critical thinking by connecting Mathematics to everyday life.

Our aim is to provide teachers with the guidance and support they need to inspire their learners, instill in them a passion for Mathematics, and help them reach their full mathematical potential. Together, we can open the doors to a world of mathematical discovery and achievement for junior high school learners.

Sub-strand 1: Number and numeration systems**Module 1****Approximations****Content standard**

B9.1.1.1 Apply the understanding of place value in solving real-life problems involving integers of any size, rounding off to given decimal places and significant figures.

Indicator

B9.1.1.1.1 Express integers to a given number of significant and decimal places.

Learning expectations: In this module, learners will learn how to:

- Express integers to a number of significant and decimal places.
- Apply the understanding of place value in solving real-life problems.

Essential for learning: Learners can write four- and five- digit numbers in words.

Resources: Number work cards

Keywords: standard form, significant figure, decimal place, decimal point, accuracy, round up, round down

Competencies: Communication and collaboration, Creativity and Innovation, Personal development and leadership

Starter: Refer learners to Learner's Book page 2 for the starter activity.

Main idea 1

Rounding integers to a number of significant figures

LB page 2

Activity 1: In Basic 8, learners learnt how to express integers in a given number of significant figures.

Revise the rules for determining how many significant figures are in a number. You may refer learners to page 3 in the Learner's Book.

Activity 2: Put learners into convenient groups. Write some numbers on the board and ask them to correct the numbers to a given number of significant figures.

Examples: **1.** Correct 62,854 to two significant figures = 63,000

2. Correct 0.002856 to three significant figures = 0.00286

Activity 3: Refer learners to pages 2 and 3 of the Learner's Book. Go through Main idea 1 and the worked examples with them.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs to round off each number to one and to two significant figures.

1. a. 641 b. 204 c. 3,420

Challenging activity

Correct these numbers to two and three significant figures.

- 1.** 0.004208 **2.** 650.305

Assessment tasks ----- LB page 4–5

Refer learners to pages 4 and 5 of the learner's book for exercise.

Suggested homework

1. Round 6,204 to
 - a. One significant figure
 - b. three significant figures
2. Correct 2.0058 to
 - a. One significant figure
 - b. three significant figures

Main idea 2

Express decimal numbers to a given number of decimal places

Activity 1: Revise the previous lesson on correcting numbers to a given number of significant figures with learners. Example: Correct 62,450 to one significant figure and four significant figures.

Activity 2: Write some numbers on the board and demonstrate how to express them to the number of decimal places required. Example: Round off 30.567 to one decimal and two decimal places.

30.567 to one decimal place, we consider the second figure after the decimal point which is 6, 6 is more than 5 so we add 1 to the number before it.

$\therefore 30.567$ to one decimal place 30.6

Activity 3: Pair learners and go through the Main 2 on page 5 of the Learner's Book with them.

Activity 4: Go through the worked examples on pages 6 and 7 with learners. Have them work in groups of four.

Review exercise

Differentiated lessons

Remedial activity

Round off

1. 6,24.680 to one decimal place
2. 2.00589 to two decimal places

Challenging activity

Round off

1. 2.00123 to three decimal places
2. 7,485,02199 to two decimal places

Assessment tasks ----- LB page 6–7

Refer learners to pages 6 and 7 of the learner's book for exercise.

Suggested homework

Round off each number to the accuracy given in brackets.

1. 32.6666 to (3 decimal places)
2. 201.0025 to (2 decimal places)
3. 0.005678 to (4 decimal places)

Main idea 3

Using the knowledge and understanding of place value to solve real-life problems

LB page 7

Activity 1: Explain to learners that in solving real-life problems using place value, they have to read the questions very well and understand them. They have to know the place value system as well.

Revise the place value system with the class. Ask learners to write a seven-digit number and explain each digit to the learner next to him/her. Example: 6,234,201

- 6: Six million
- 2: Two hundred thousand
- 3: Thirty thousand
- 4: Four thousand,
- 2: Two hundred
- 0: Zero tens
- 1: One ones.

Activity 2: Put learners into groups of three. Write a word problem on the board and ask learners to solve the problem in their groups.

Example: I am a four-digit number. My last digit is 9. My first digit is the second multiple of 3. My second digit is the quotient of 12 and 4 and my third digit is the fourth multiple of 2. Who am I? The number is 6,389.

Activity 3: In their previous groups, ask learners to brainstorm to solve the worked examples on pages 8 and 9 of the Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

I am a four-digit number, my first digit is the second multiple of 3 and the second digit is 3 less than the first digit. The third digit is 1 less than the second digit and the last digit is the first multiple of seven. What number am I? Write your answer in standard form.

Challenging activity

I am a four-digit number. My first digit is 4 more than the last digit. My second digit is the third multiple of 2 while my fourth digit is the second multiple of 3. What is my number? Write your answer in standard form.

Assessment tasks ----- LB page 9

Refer learners to page 9 of the Learner’s Book for the questions.

Suggested homework

- I am a three-digit number and a multiple of 2. My first digit is the second multiple. My third digit is the fourth multiple and my first digit is 2. Who am I?
- I am a four-digit number. My first digit is the second multiple of 2. My second digit is one more than the first digit. My last digit is the first prime number and my last digit is the second multiple of 3. Who am I? Write your answer in standard form.

Answers to Assessment tasks

Main idea 1

1.

a. 400

b. 80

c. 8,000

d. 0.6

e. 0.008

2.

a. 760

b. 950

c. 4,700

d. 3.0

e. 0.00100

3.

a. 4 (sf)

b. 4 (sf)

c. 1 (sf)

d. 4 (sf)

e. 8 (sf)

f. 6 (sf)

g. 7 (sf)

h. 7 (sf)

i. 4 (sf)

j. 3 (sf)

4.

Number	Correct to 1 (sf)	Correct to 3 (sf)	Correct to 4 (sf)	Correct to 5 (sf)
a. 765,458,123	800,000,000	765,000,000	765,500,000	765,460,000
b. 48,227,839	50,000,000	48,200,000	48,230,000	48,228,000
c. 32,436,688	30,000,000	32,400,000	32,440,000	32,437,000

(LB page 4–5)

Sub-strand 1: Number and numeration systems**Module 2****Real number system****Content standard**

B9.1.1.1.2 Demonstrate an understanding of the relationship between members of the rational number system and solve real-life problems involving union and intersection of three sets.

Indicator

B9.1.1.1 Solve problems on relationships between members of the rational number system using knowledge and understanding of the concept of union and intersection of two sets.

Learning expectations: In this module, learners will learn how to:

- Use set diagrams to show the relationships between real numbers.
- Represent factors of numbers on a Venn diagram.

Essential for learning: Learners can put the number of members of two sets into a Venn diagram.

Resources: Real number chart

Keywords: integers, natural numbers, real numbers

Competencies: Communication and collaboration, Creativity and innovation

Starter: Refer learners to page 10 of the Learner's Book for warming up activity.

Main idea 1

Rational and irrational numbers

LB page 10

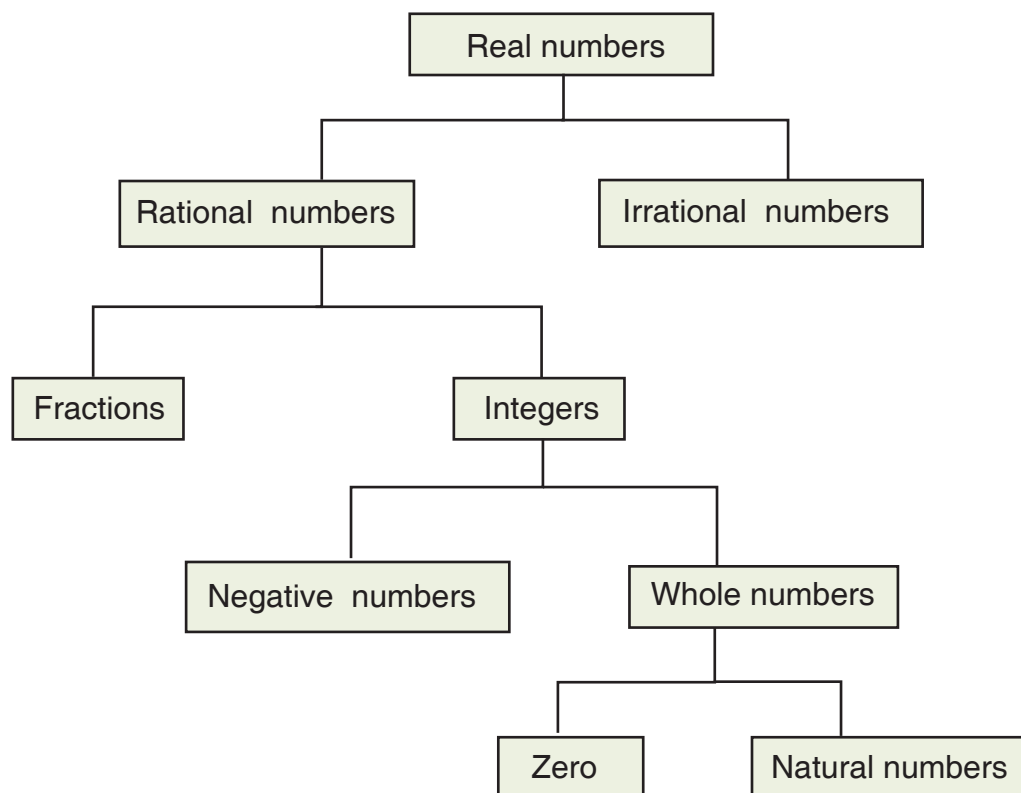
Activity 1: Put learners into convenient groups. Explain what natural and whole numbers are. Ask learners to give examples. Ask each learner to write one example using the symbols.

$$N = \{1, 2, 3, 4, 5, 6, 7, 8, \dots\}$$

$$W = \{0, 1, 2, 3, 4, 5, \dots\}$$

Activity 2: Continue to explain integers, rational and irrational numbers to learners. Display the real number chart on the board. Discuss the chart with the class and let each group give examples for each type of number.

Real number chart



Activity 3: Ask learners to work in pairs. Go through the worked examples with learners. Read and explain Main idea 1 on pages 10 and 11 to them.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs to solve these.

1. Write the first six numbers of whole numbers.
2. Write the eleventh to thirtieth whole numbers.

Challenging activity

List the members in the set that are rational, irrational and integers.

Set A $\{\frac{2}{3}, 0, 5, -6, \sqrt{4}, 2.68, \pi\}$

Assessment tasks ----- LB page 12

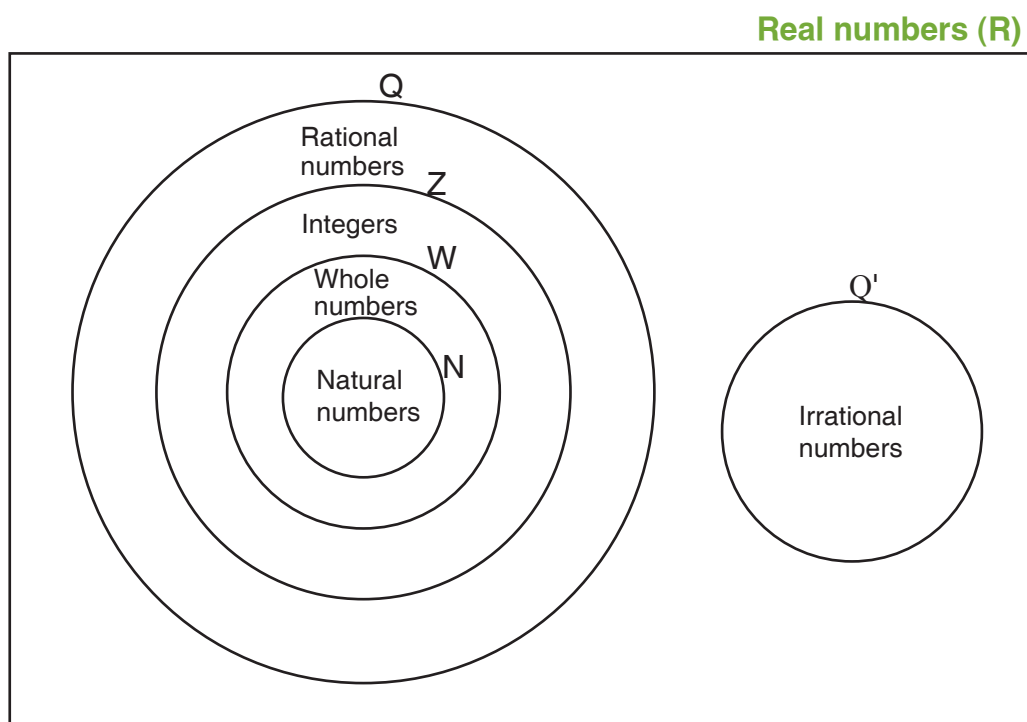
Refer learners to Learner's Book page 12 for the questions.

Suggested homework

Write the subset of real numbers to which each number belongs.

- | | | | |
|-----------|----------------|--------------------|-----------------|
| 1. -144 | 2. 0.285 | 3. $\frac{5}{8}$ | 4. $\sqrt{100}$ |
| 5. 21.333 | 6. $-\sqrt{4}$ | 7. $\frac{22}{77}$ | |

Activity 1: Have learners draw the real number chart in their jotters. Guide them to draw a Venn diagram as shown on page 13 of the Learner's Book.



Activity 2: Guide learners to separate the given numbers into whole numbers, integers and rational numbers. Let them write them in their jotters.

Activity 3: Write a question on the board in which you ask learners to write the numbers in a Venn diagram: 1 , $\sqrt{2}$, 10 , $\frac{5}{6}$, π , 4

Activity 4: Go through the worked examples on pages 15 to 18 with learners. Let them work in pairs.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Use a Venn diagram to classify these numbers: $\sqrt{3}$, 16 , 0 , $\frac{2}{3}$, 17

Challenging activity

Work in pairs.

Use Venn diagram to show the relationship between the following real numbers:

-8 , $\frac{3}{7}$, π , 0 , -6 , $\frac{1}{2}$, $-\frac{3}{4}$, π

Assessment tasks ----- LB pages 18–19

Refer learners to pages 18 and 19 of the Learner's Book for the questions.

Suggested homework

1. 24 and 12

Represent the factors of the following numbers on a Venn diagram.

2. Represent on a Venn diagram: $\sqrt{2}$, π , -6 , 6 , $\frac{2}{3}$, $-\frac{1}{4}$, $\frac{22}{7}$

Answers to Assessment tasks

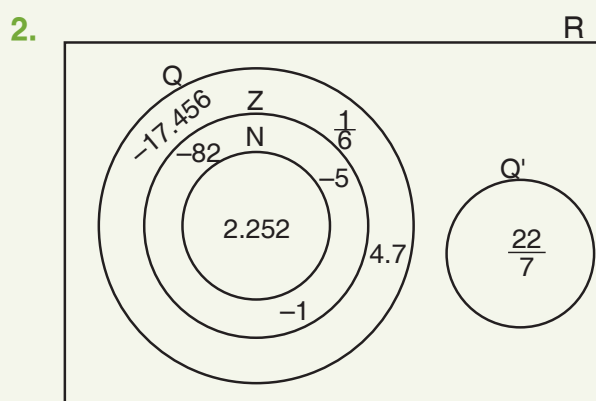
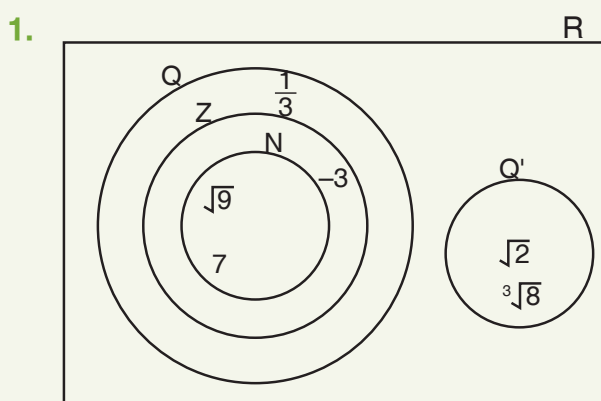
Main idea 1

(LB page 12)

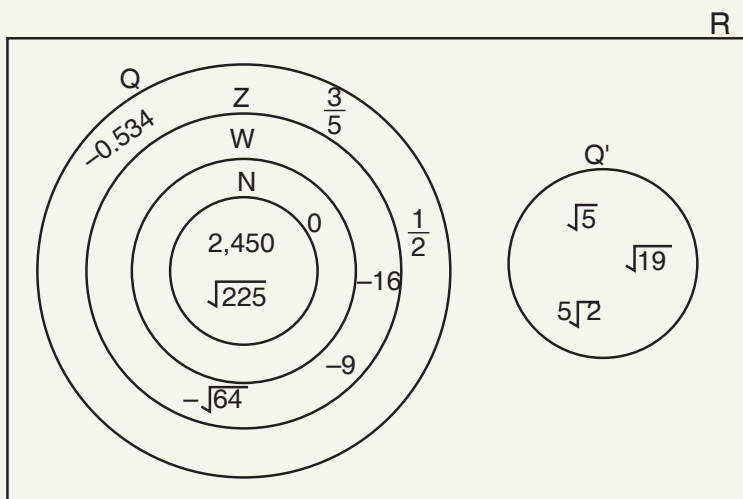
1.
 - a. Irrational numbers
 - b. Irrational numbers
 - c. Whole numbers
 - d. Integers
 - e. Integers
 - f. Rational numbers
 - g. Irrational numbers
 - h. Integers
 - i. Rational numbers
 - j. Rational numbers
2.
 - a. Integers
 - b. Rational numbers
 - c. Irrational numbers
 - d. Integers
 - e. Rational numbers
3.
 - a. Natural numbers, whole numbers and rational numbers
 - b. Whole number, integer and rational number
 - c. Natural number, integer and rational number
 - d. Rational number
 - e. Irrational number

Main idea 2

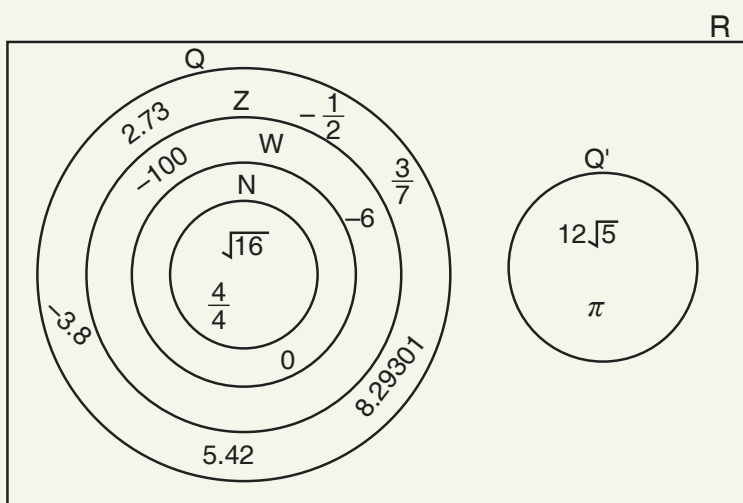
(LB pages 18–19)



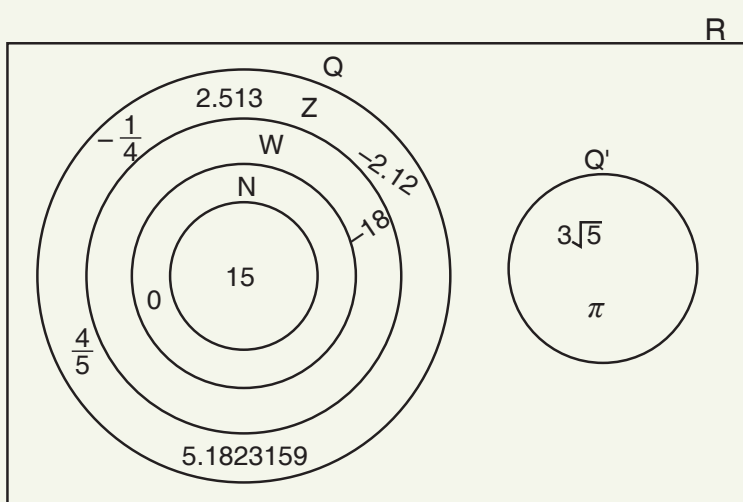
3.



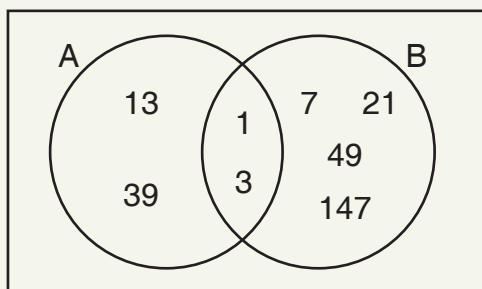
4.



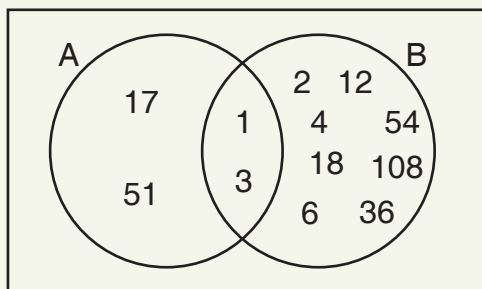
5.



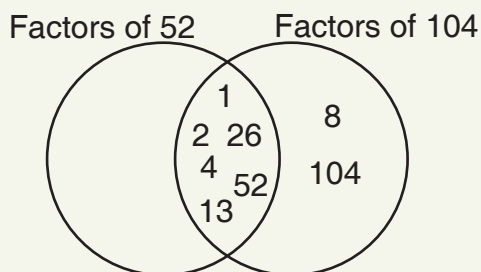
1. $A = \{\text{factors of } 39\}$ and $B = \{\text{factors of } 147\}$
 $A = \{1, 3, 13, 39\}$ and $B = \{1, 3, 7, 21, 49, 147\}$



2. $A = \{\text{factors of } 51\}$ and $B = \{\text{factors of } 108\}$
 $A = \{1, 3, 17, 51\}$ and $B = \{1, 2, 3, 4, 6, 12, 18, 36, 54, 108\}$

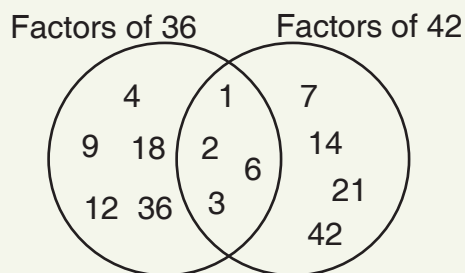


3. Factors of 52 = $\{1, 2, 4, 13, 26, 52\}$
 Factors of 104 = $\{1, 2, 4, 8, 13, 26, 52, 104\}$



Common factors of 52 and 104 = $\{1, 2, 4, 13, 26, 52\}$

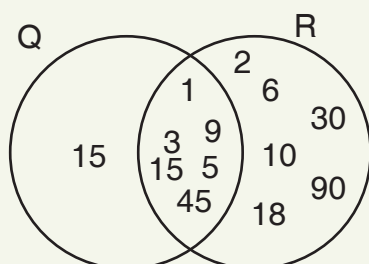
4. a. Factors of 36 = $\{1, 2, 3, 4, 6, 9, 12, 18, 36\}$
 Factors of 42 = $\{1, 2, 3, 6, 7, 14, 21, 42\}$



Common factors = $\{1, 2, 3, 6\}$

b. $Q = \{\text{Factors of } 45\} = \{1, 3, 5, 9, 15, 45\}$

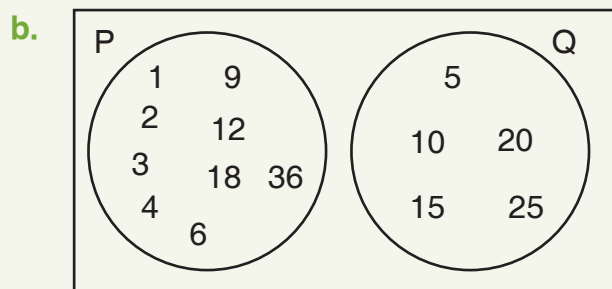
$R = \{\text{Factors of } 90\} = \{1, 2, 3, 5, 6, 9, 10, 15, 18, 30, 45, 90\}$



Common factors = $\{1, 3, 5, 9, 15, 45\}$

5. a. $P = \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$

$Q = \{5, 10, 15, 20, 25\}$



$P \cap Q = \emptyset$

$P \cup Q = \{1, 2, 3, 4, 5, 6, 9, 10, 12, 15, 18, 20, 25, 36\}$

Sub-strand 1: Number and numeration systems**Module 3****Application of sets****Content standard**

B9.1.1.2 Demonstrate an understanding of the relationship between members of the rational number system and solve real-life problems involving union and intersection of three sets.

Indicator

B9.1.1.2.2 Apply the concept of sets to solve problems on the relationships between members of the rational number system and solve real-life problems involving the the union and intersection of two sets.

Learning expectations: In this module, learners will learn how to:

- Solve real-life problems to show the union and intersection of two sets.

Essential for learning: Learners can find factors of two or more numbers.

Resources: Real numbers chart on cards

Keywords: real numbers, union of sets, intersection of sets

Competencies: Communication and collaboration

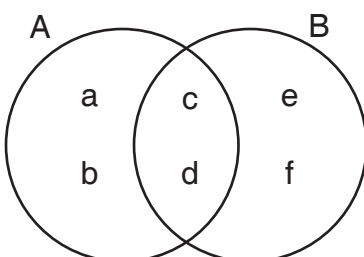
Starter: Refer learners to page 20 of the Learner's Book for the starter activity.

Main idea 1

Real-life problems on sets

LB page 20

Activity 1: Put learners into convenient groups. Deduce from them what they know about the intersection and union of sets. Let them write the two symbols in their jotters. Draw two sets A and B with members and let learners identify the union and the intersecting members. Let them use the symbols.



Activity 2: $A \cup B = \{a, b, c, d, e, f\}$

$$A \cap B = \{c, d\}$$

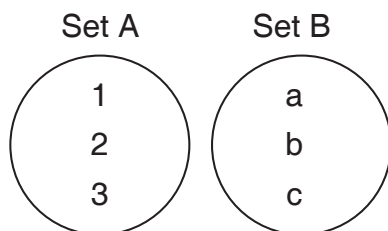
So, $A \cup B$ is the set of all members that belong to A and B.

$A \cap B$ is the set of all the elements that are found in A and B.

In their groups, ask learners to write two separate sets and find the union and intersection of the two sets.

Activity 3: Refer learners to page 21 of the Learner's Book. Go through the symbols and the description on page 21 with learners.

Let them know that disjoint sets are two sets that do not have a common member.



Activity 4: Go through the worked examples on pages 22 to 25 with learners.

Review exercise

Differentiated lessons

Remedial activity

Ask learners to work in pairs.

Set A = {multiples of 5 up to 30}

Set B = {factors of 30 up to 35}

Find the following

1. $(A \cup B)$
2. $(A \cap B)$
3. Draw a Venn Diagram that shows $(A \cup B)$ and $(A \cap B)$.

Challenging activity

Ask learners to work in pairs.

Let A and B be two finite sets, $n(A) = 40$, $n(B) = 25$ and $A \cup B = 30$. Find $n(A \cap B)$. Use the formula $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

Assessment tasks ----- LB pages 25–26

Refer learners to Learner's Book page 25–26 for the questions.

Suggested homework

In a class of 40 learners, every learner studies Mathematics or History or both. If 32 learners study Mathematics and 25 study History. Find the number of learners who study Mathematics only.

Answers to Assessment tasks

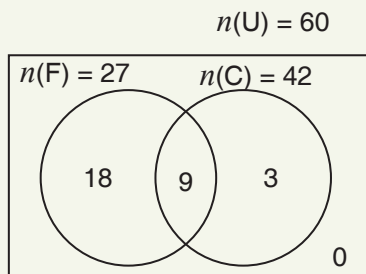
Main idea 1

(LB pages 25–26)

1. $n(A \cap B) = 12$

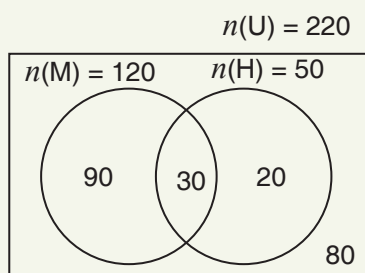
2. $n(B) = 27$

3.



Nine persons like both drinks.

4. a.

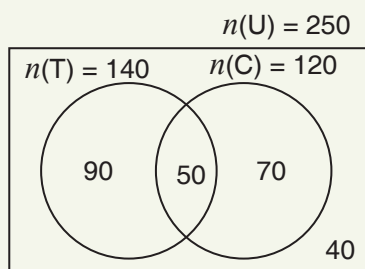


b. i. 90

ii. 20

iii. 140

5. a.



b. i. 90

ii. 70

iii. 160

iv. 40

v. 210

Answers to Revision

1

(LB pages 27–28)

1. 135,000,000

2. a. 10,000

b. 11,000

c. 10,700

3. a. 0.3

b. 0.000

c. 509.5

d. 8,475.0035

4. a. 3,540,000

b. 756.87673

c. 0.01

d. 17,090

5. 7,228

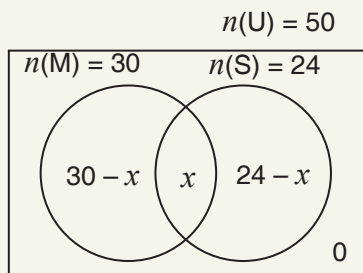
6. 68

7. 5,937

8. a. i. 30

ii. 24

b.



c. i. 4

ii. 26

9. a. $P = \{2, 4, 6, 8, 10, 12, 14, 16\}$

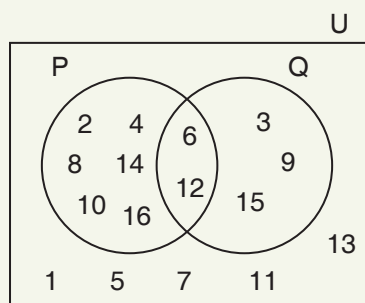
$Q = \{3, 6, 9, 12, 15\}$

$U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16\}$

$P \cap Q = \{6, 12\}$

$(P \cup Q)' = \{1, 5, 7, 11, 13\}$

b.



10. a. $A = \{1, 2, 3, 6, 9, 18, 27, 54\}$

$B = \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$

b. i. $A \cap B = \{1, 2, 3, 6, 9, 18\}$

ii. $n(A \cap B) = 6$

iii. 18

Sub-strand 2: Number operations**Module 1****Multiplication and division of numbers by powers of 10****Content standard**

B.9.1.2.1 Apply mental mathematics and properties to determine answers for addition and subtraction of basic facts.

Indicator

B9.1.2.1.1 Multiply and divide given numbers by powers of 10 including decimals and benchmark fractions.

Learning expectations: In this module, learners will learn how to:

- Consolidate the rapid recall of multiplication and division facts.
- Consolidate the rapid recall of bench mark fractions converted to decimals and percentages.
- Find the product of decimal numbers and powers of 10.

Essential for learning: Learners can write numbers in standard form.

Resources: Multiplication

Keywords: multiplication facts, division facts

Competencies: Creativity and innovation

Starter: Refer learners to page 29 of the Learner's Book for the starter activity.

Main idea 1

Multiplication and division facts

LB page 29

Activity 1: This year, learners have learnt about multiplication and division facts. Write an example on the board and ask learners to solve it in pairs, for example: $6 \times 4 = 24$. Encourage learners to write the two related facts of $6 \times 4 = 24$ as $24 \div 4 = 6$ and $24 \div 6 = 4$. These relations are the fact family.

Activity 2: Have learners work in convenient groups. Let them set their own questions and solve them. Ask groups to compare their work with the other groups' work.

Activity 3: Go through the worked examples on pages 31 to 33 with learners. Call some learners to demonstrate by working answers out on the board.

Review exercise

Differentiated lessons

Remedial activity

Form multiplication and division equations for each set of numbers.

1. 72, 12 and 6 2. 100, 20 and 5

Challenging activity

Work in pairs.

Find the missing numbers in each multiplication and division fact family.

1. 200, 20, x 2. x , 13, 5

Assessment tasks ----- LB pages 30–31

Refer learners to Learner's Book pages 30 and 31 for the questions.

Suggested homework

Write the related multiplication and division facts for each set of numbers.

1. 10, 11, 110 2. 156, 12, 13 3. 14, 12, 168 4. 60, 12, 720

Main idea 2

Convert fractions to decimals and percentages

LB page 31

Activity 1: Revise the previous lesson with learners. Demonstrate on the board how to change fractions to decimals and percentages. Example: $\frac{7}{10} = 0.7$ and $0.7 \times 100 = 70\%$

Activity 2: Put learners in convenient groups. Let them write their own questions and convert numbers to decimals and percentages. Invite some groups to present their work on the board.

Activity 3: Go through the worked examples with learners on pages 31–33 in the Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Have learners work in pairs to solve these.

Change the following fractions to decimals and percentages.

1. $\frac{9}{10}$ 2. $\frac{17}{100}$ 3. $\frac{3}{5}$

Challenging activity

1. Convert the fractions into decimals and percentages.
 - a. $\frac{27}{20}$
 - b. $\frac{7}{10}$
 - c. Convert 0.25 into a fraction and a percentage.
 - d. Change 35% into a decimal number and a fraction.

Assessment tasks ----- LB page 33

Refer learners to page 33 of the Learner's Book for exercise.

Suggested homework

1. Change the following fractions into decimals and percentages.
 - a. $\frac{7}{100}$
 2. $\frac{29}{1000}$
2. Change the following to fractions and percentages.
 - a. 0.37
 - b. 6.25
 - c. 2.15

Main idea 3

Products and quotient of decimal numbers and powers of 10
LB page 34

Activity 1: Refer learners to page 34 of the Learner's Book. Go through the steps with them. Demonstrate with examples as a learner reads the steps.

Activity 2: Have learners work in pairs. Write a question on the board and let them work out the answers. Example: 6.45×10 . Let them use the steps they read. A partner asks a questions based on the steps. Example: How many zeros do we have? By counting one decimal place where should the point be? So, $6.45 \times 10 = 64.5$.

Activity 3: Put learners into convenient groups. Take them through the worked examples on pages 34 to 36.

Activity 4: In their groups, have learners set their own questions and solve them. They exchange problems and solutions with the groups next to them to check whether the answers are correct. If not, they correct their solutions.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs to solve these problems.

1. 6.25×10
2. 4.280×100
3. Divide $\frac{1.256}{100}$

Challenging activity

Work in pairs. Work out the answers.

1. $62.45 \times \frac{1}{10}$

2. 6.21×1000

Assessment tasks ----- LB page 36–37

Refer learners to pages 36 and 37 of the Learner's Book for the questions.

Suggested homework

Work out the answers.

1. 3.64×100

2. 1.0042×10

3. $47.682 \div 100$

4. $97.12 \times \frac{1}{1,000}$

Answers to Assessment tasks

Main idea 1

(LB pages 30–31)

1. a. $8 \times 3 = 24$

b. $8 \times 12 = 96$

c. $9 \times 6 = 54$

$3 \times 8 = 24$

$12 \times 8 = 96$

$6 \times 9 = 54$

$24 \div 8 = 3$

$96 \div 8 = 12$

$54 \div 9 = 6$

$24 \div 3 = 8$

$96 \div 12 = 8$

$54 \div 6 = 9$

2. a. $11 \times 8 = 88$

b. $9 \times 12 = 108$

c. $8 \times 9 = 72$

$8 \times 11 = 88$

$12 \times 9 = 108$

$9 \times 8 = 72$

$88 \div 11 = 8$

$108 \div 9 = 12$

$72 \div 8 = 9$

$88 \div 8 = 11$

$108 \div 12 = 9$

$72 \div 9 = 8$

3. a. 40

b. 24

c. 5

d. 144

Main idea 2

(LB page 33)

1. a. 0.37 and 37%

b. 0.08 and 8%

c. 1.7 and 170%

d. 0.407 and 40.7%

e. 0.025 and 2.5%

2. a. 0.667

b. 0.6

c. 0.32

d. 0.8

e. 0.004

f. 0.028

3. a. $\frac{7}{10}$; 70%

b. $\frac{3}{20}$; 15%

c. $\frac{5}{8}$; 62.5%

d. $\frac{7}{200}$; 3.5%

e. $\frac{81}{500}$; 16.2%

4. a. $\frac{27}{25}$; 108%

b. $\frac{25}{4}$; 625%

c. $\frac{15}{4}$; 375%

d. $\frac{81}{40}$; 202.5%

Main idea 3

(LB pages 36–37)

1. a. i. 105
ii. 1050
iii. 10,500
b. i. 56.85
ii. 568.5
iii. 5,685
2. a. 243 b. 37.5 c. 540 d. 63,456
3. a. 0.0625 b. 0.00345 c. 2.805
d. 4.51 e. 0.02492
4. a. i. 0.442
ii. 0.0442
iii. 0.00442
b. i. 898.11
ii. 89.811
iii. 8.9811
c. i. 59.462
ii. 5.9462
iii. 0.59462
5. a. 4.98 b. 3.4235 c. 0.00634
d. 0.00004 e. 0.0030056 f. 0.8128

Sub-strand 2: Number operations

Module 2

Properties of operations

Content standard

B9.1.2.1 Apply mental mathematics and properties to determine answers for addition and subtraction of basic facts.

Indicator

B9.1.2.1.1 Multiply and divide given numbers by powers of 10 including decimals and benchmark fractions.

Learning expectation: In this module, learners will learn how to:

- Use the commutative property and the associative property to solve problems.
- Use the distributive property to solve problems.

Essential for learning: Learners can add four-digit numbers and can multiply numbers by powers of 10.

Resources: Abacus

Keywords: commutative property, associative property, distributive property

Competencies: Creativity and Innovation

Starter: Refer learners to page 38 of the Learner's Book for starter activity.

Main idea 1

Properties of operations 1

LB pages 38–39

Activity 1: Explain the properties of addition and multiplication by giving examples: $28 + 13 = 41$, $13 + 28 = 41$, so $28 + 13$ is the same as $13 + 28 = 41$.

Another example: $12 \times 10 = 10 \times 12 = 120$.

Make sure learners realise that a change in order of the position of numbers that you add or multiply do not affect the sum or product of the numbers. Hence the addition and multiplication of numbers are commutative.

Activity 2: Ask learners to work in pairs to work out the answers.

1. $20 + 85 = 85 + 20$

2. $\frac{1}{5} + \frac{3}{8} = \frac{3}{8} + \frac{1}{5}$

3. $45 \times 8 = 8 \times 45$

Activity 3: Ask learners to brainstorm the meaning of the associative property. Write an example on the board.

1. $2 + (4 + 6) = (4 + 2) + 6$

2. $3 \times (2 \times 5) = (3 \times 5) \times 2$.

Ask learners to work in convenient groups to work out the answers. Ask learners to set their own questions and solve them.

Activity 4: Demonstrate by giving subtraction and division questions to prove that subtraction and division are not commutative nor associative.

Examples: 1. $20 \div 5 \neq 5 \div 20$

2. $120 - 95 \neq 95 - 120$

Activity 5: Go through the worked examples with learners on pages 40 and 41 in the Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs. Find the value of a in the following.

1. $60 + 45 = 45 + a$

2. $6 \times (8 \times 9) = (9 \times a) \times 8$

Challenging activity

Find the value of b .

1. $(\frac{1}{3} + \frac{2}{5}) + \frac{7}{15} = (\frac{7}{15} + b) + \frac{2}{5}$

2. $(1\frac{1}{8} \times \frac{2}{3}) \times \frac{7}{12} = (b \times \frac{2}{3}) \times 1\frac{1}{8}$

Assessment tasks ----- LB pages 41– 42

Refer learners to pages 41 and 42 of the Learner's Book for exercise.

Suggested homework

Solve these.

1. $\frac{5}{6} \times \frac{2}{3}$

2. 65×13

Solve these problems if $a = 12$, $b = 10$ and $c = 5$.

3. $b \times c$

4. $a + b + c$

Main idea 2

Properties of operations 2

LB pages 42–43

Activity 1: Review the previous lesson on commutative and associative properties with learners.

Activity 2: Distributive property.

Write this on the board: $a \times (b + c) = ab + ac$.

Ask learners to work in pairs and to brainstorm what the equation means. Write a question on the board, for example simplify $3(4 + 10)$.

Guide them to use the first statement to solve it:

1. $3(4 + 10) = (3 \times 4) + (3 \times 10)$

2. $a \times (b - c) = ab - ac$

Example: $4(6 - 2) = (4 \times 6) - (4 \times 2) = 24 - 8 = 16$

In pairs, ask learners to each set one question on addition and subtraction and then to solve the problems together. Ask them to exchange their work with the pair next to them and check, and correct the answers, if necessary.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs to work out the answers using the distributive property.

1. $6(4 + 9)$

2. $10(8 - 6)$

Challenging activity

Esi, Edem and Fuseni have 12, 10 and 14 exercise books, respectively. Use the distributive property to find the total number of exercise books that belong to the three learners.

Go through the worked examples on pages 43 and 44 in the Learner's Book with learners.

Assessment tasks ----- LB pages 44–45

Refer learners to pages 44 and 45 of the Learner's Book for the questions.

Suggested homework

Find each product using distributive property.

1. 20×18

2. 59×6

3. $6(18 - 12)$

4. $10(6 + 7)$

Answers to Assessment tasks

Main Idea 1

(LB pages 41–42)

1. a. 122

b. 137

c. 3,640

d. 54,600

2. a. $52 + 70 = 70 + 52 = 122$

$(52 + 70) + 15 = 52 + (70 + 15) = 137$

$70 \times 52 = 52 \times 70 = 3,640$

$52 \times (70 \times 15) = (52 \times 70) \times 15 = 54,600$

b. The commutative property of addition is shown in *a* and *b*.

The commutative property of multiplication is shown in *c* and *d*.

The associative property of addition is shown in *e* and *f*.

The associative property of multiplication is shown in *g* and *h*.

c. Commutative property

Associative property

$25 + 39 = 64$

$25 + (39 + 15) = 79$

$39 + 25 = 64$

$(25 + 39) + 15 = 79$

$$25 \times 39 = 975$$

$$39 \times 25 = 975$$

$$25 \times (39 \times 15) = 14,625$$

$$(25 \times 39) \times 15 = 14,625$$

3. a. \times b. $+$ c. $+$ d. \times
4. a. Commutative property of multiplication
b. Commutative property of addition
c. Commutative property of addition
d. Commutative property of multiplication
5. a. $6 \times (4 \times 5)$ and $(6 \times 4) \times 5$ b. $6 + (89 + 48)$ and $(6 + 89) + 48$
6. a. $144 + 205 = 205 + 144 = 349$ b. $144 \times 205 = 205 \times 144 = 29,520$
7. 81
8. a. $+$; $+$ b. \times ; \times c. 12 d. 112
9. Associative property
10. a. No, subtraction and division are not commutative.
 $2 - 3 = -1$ and $3 - 2 = 1 \quad \therefore 2 - 3 \neq 3 - 2$
 $6 \div 2 = 3$ and $2 \div 6 = \frac{1}{3} \quad \therefore 6 \div 2 \neq 2 \div 6$
b. No, subtraction and division are not associative
 $(6 - 2) - 3 = 1$; $6 - (2 - 3) = 7 \quad \therefore (6 - 2) - 3 \neq 6 - (2 - 3)$
 $(6 \div 2) \div 3 = 1$; $6 \div (2 \div 3) = 9 \quad \therefore (6 \div 2) \div 3 \neq 6 \div (2 \div 3)$

Main Idea 2

(LB pages 44–45)

1. a. 27 b. 161 c. 232
d. 135 e. 315
2. a. 52 b. 66 c. 1,275 d. 600
3. a. 76 b. 90 c. 84 d. 114
4. 42
5. a. GH¢(45.00 + 24.00 + 150.00) = GH ¢219.00
b. $11 \times (\text{GH¢}45.00 + \text{GH¢}24.00 + \text{GH¢}150.00) = \text{GH¢}2,409.00$

Activity: Check learners' answers

Sub-strand 2: Number operations

Module 3

Surds

Content standard

B9.1.2.4 Demonstrate understanding of surds as real numbers, the process of adding and subtracting surds as well as determining (using a calculator) the approximate square root of a number that is not a perfect square.

Indicator

B9.1.2.4.1 Identify simple and compound surds.

Learning expectations: In this module, learners will learn how to:

- Identify the types of surds and explain the rules of surds.
- Simplify given surds.
- Approximate the square roots of non-perfect squares.

Essential for learning: Learners can write powers of numbers.

Resources: Four-figure tables

Keywords: simplify surd, compound surd, conjugate, square root, non-perfect square

Competencies: Critical thinking and problem solving, Communication and collaboration, Creativity and Innovation

Starter: Refer learners to page 46 in the Learner's Book for the starter activities.

Main idea 1

Definition, types and rules of surds

LB pages 46–48

Activity 1: Refer learners to Main idea 1 on pages 46 to 48 in the Learner's Book. Guide and go through the types of surds one by one with learners. Encourage them to give their own examples. Example: Mixed surds are not completely irrational and can be expressed as the product of a rational number and an irrational number. For example, $3\sqrt{2}$, $2\sqrt{5}$, $p\sqrt{q}$, and $20\sqrt{3}$ are mixed surds.

Activity 2: Go through Main idea 1 on pages 46 to 48 in the Learner's Book with learners. Explain the different types and rules for each surd to learners.

Activity 3: Go through the worked examples with learners (pages 48 and 49 in the Learner's Book).

Activity 4: In pairs, guide learners to solve the worked examples on pages 48 and 49.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Write these surds as mixed surds.

1. $\sqrt{8}$

2. $\sqrt{39}$

Challenging activity

Work in pairs to simplify the problems.

1. $\sqrt{40} \div \sqrt{4}$

2. $4 + 2\sqrt{5}$

Assessment tasks ----- LB pages 49 and 50

Refer learners to pages 49 and 50 of the learner's book for the questions.

Suggested homework

1. Write each surd as a mixed surd.

a. $\sqrt{20}$

b. $\sqrt{48}$

c. $\sqrt{16}$

2. Write the conjugate form of each problem.

a. $3 + 2\sqrt{5}$

b. $3 - 2\sqrt{41}$

Main idea 2

Simplifying surds

LB page 50

Activity 1: Revise the previous lesson with learners. Demonstrate how to simplify surds on the board. Example: $\sqrt{8}$

$$\sqrt{8} = \sqrt{2 \times 4} = \sqrt{2} \times \sqrt{4} = \sqrt{2} \times 2 = 2\sqrt{2}.$$

Activity 2: Pair learners and go through the worked examples with them. Let each pair come out with their own question and work together to solve it.

Activity 3: Let learners know that to add or subtract surds, the numbers under the radical or roots sign must be the same. Write an example on the board, pair learners and let them solve it.

Example: $3\sqrt{2} + 5\sqrt{2} - 4\sqrt{2}$

$$(3 + 5 - 4)\sqrt{2} = 4\sqrt{2}$$

Go through the steps with learners.

Steps to follow to simplify surds

Step 1: Find the square number that is a factor of the number in the square root sign.

Step 2: Rewrite the surd as a product of this square number and another number, then evaluate the root of the square number.

Step 3: Repeat if the number in the root sign has square factor.

Activity 4: Go through the worked examples on pages 51 and 52 in the Learner's Book with learners.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs. Simplify the following.

1. $\sqrt{3} + \sqrt{3} + 2 + \sqrt{3}$

2. $\sqrt{8} + \sqrt{2}$

Challenging activity

1. $12 \times \sqrt{121} + 6$

2. $\sqrt{30} + \sqrt{5} + 6$

Assessment tasks ----- LB page 53

Refer learners to page 53 of the Learner's Book for the questions.

Suggested homework

Simplify these.

1. $\sqrt{150} - \sqrt{54}$

2. $2 \times \sqrt{8} \times \sqrt{2} + 5$

3. $\frac{\sqrt{32}}{\sqrt{8}}$

4. $3\sqrt{121} \times 4\sqrt{11}$

Main idea 3

Approximating the square root of a non-perfect square

LB pages 54–55

Activity 1: Have learners work in pairs. Give four-figure tables to each pair. Go through Main idea 3 with learners. Ask some learners to read while you give explanations. Let them refer to the four-figure tables on pages 326 to 329 in the Learner's Book at the appropriate time.

Activity 2: Guide learners to go through the worked examples in question 1 (a, b, c, and d) using their four-figure tables. Refer them to pages 56 and 57 in the Learner's Book.

Activity 3: Have learners work in convenient groups to solve these. Let them use the four-figure tables. Find the square root of each number.

1. 487

2. 2491

Activity 4: Refer learners to the worked examples on pages 56 and 57 in the Learner's Book. Go through the examples with them.

6. a. $\frac{2}{3}\sqrt{3}$ b. 3 c. $\frac{1}{6}\sqrt{3}$ d. $3 + \sqrt{7}$
 7. a. $3\sqrt{7}$ b. $7\sqrt{5}$ c. $4\sqrt{2}$ d. $-6 + 12\sqrt{2}$
 e. $\frac{1}{3} + \frac{2}{15}\sqrt{10}$ f. $8\sqrt{6}$ g. $11\sqrt{3}$
 8. Width = $(-8 + 4\sqrt{7})$ cm
 9. Height = $(2 + 2\sqrt{3})$ cm
 10. Width = $(4 - \sqrt{7})$ m

Main idea 3

(LB page 58)

1. a. 19.67 b. 82.64 c. 37.12
 d. 54.23 e. 65.05
 2. a. 4.162 b. 26.13 c. 5.930
 d. 22.90 e. 2.021 f. 0.007608
 3. a. 0.03464 b. 0.1196 c. 0.02381
 d. 0.09050 e. 0.007608

Answers to Revision

2

(LB page 59)

1. a. i. $6 \times 4 = 24$ and $4 \times 6 = 24$
 ii. $12 \times 11 = 132$ and $11 \times 12 = 132$
 iii. $3 \times 9 = 27$ and $9 \times 3 = 27$
 b. i. $48 \div 4 = 12$ and $48 \div 12 = 4$
 ii. $75 \div 3 = 25$ and $75 \div 25 = 3$
 iii. $278 \div 2 = 139$ and $278 \div 139 = 2$
 2. a. $0.8 = 80\%$ b. $0.15 = 15\%$ c. $0.82 = 82\%$
 d. $0.875 = 87.5\%$ e. $0.8125 = 81.25\%$
 3. $0.75 = 75\%$
 4. a. $\frac{13}{20} = 65\%$ b. $\frac{3}{5} = 60\%$ c. $\frac{1}{50} = 2\%$
 5. a. 70.02 b. 460,000
 6. a. i. 342 ii. 4,340 iii. 76
 b. i. 2.83 ii. 0.00825 iii. 0.000000342
 7. $-18y + 12$

8. a. $47 + 72 = 72 + 47$

b. $(3 \times 4) \times 6 = 3 \times (4 \times 6)$

9. a. $9\sqrt{3}$

b. $3\sqrt{35}$

c. $\frac{10\sqrt{5}-5}{19}$

c. $47\sqrt{5}$

e. $34 + 16\sqrt{5}$

10. a. 3.606

b. 9.950

c. 11.091

d. 0.5916

e. 0.1414

Sub-strand 3: Fractions, decimals and percentages

Module 1

Fractions, decimals and percentages

Content standard

B9.1.3.1 Apply the understanding of operations on fractions to solve problems involving fractions of given quantities and round off the results to given decimal and significant places.

Indicator

B9.1.3.1.1 Review fractions and solve problems involving basic operations on fractions.

Learning expectations: In this module, learners will learn how to:

- Review operations on common fractions.
- Review operations on decimals and percentages.

Essential for learning: Learners can use the four operations to solve addition, subtraction and multiplication of fractions.

Resources: Strips of paper, crayons

Keywords: Fraction, decimal, percentage

Competencies: Critical thinking and problem solving, Communication and collaboration, Personal development and leadership, Creativity and innovation.

Starter: Refer learners to page 60 of the Learner's Book for the starter exercise.

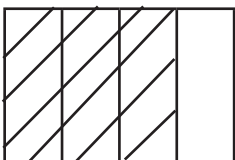
Main idea 1

Operations on common fractions

LB page 60

Activity 1: Remind learners that they solved questions on the four operations last year. Task them to explain the concept of fractions. Let them mention a fraction, draw it in their jotters and colour it.

Example:



$$\frac{3}{4}$$

Activity 2: Ask learners to tell you what they have to do if they are adding or subtracting unlike fractions. Expect them to tell you that they have to find a common denominator. Let them give their own examples. Write a few problems on the board and call learners to solve work out the answers on the board.

Activity 3: Put learners into convenient groups to add the fractions.

1. $\frac{2}{3} + \frac{1}{5}$

2. $\frac{7}{10} + \frac{2}{5}$

Multiplication and division of fractions

Activity 4: Ask learners to explain how to multiply fractions. (Simply multiply the numerators and the denominators separately and reduce the product to its simplest form if necessary.)

So, $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$. Give more examples for learners to work in pairs to solve.

Activity 5: Write a multiplication sentence on the board and ask learners to tell you how they will solve it, for example, $\frac{1}{4} \times \frac{5}{6}$. Have learners work in pairs.

Activity 6: Similarly, remind learners that to divide two or more fractions, we multiply the first fraction by the reciprocal of the second fraction.

So, $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$

Put learners into convenient groups to solve these.

1. $\frac{3}{5} \div \frac{4}{8}$

2. $\frac{17}{20} \div \frac{3}{8}$

3. $\frac{5}{8} \div \frac{15}{9}$

Review exercise

Differentiated lessons

Remedial activity

Ask learners to work in mixed ability groups and work out the answers.

1. $\frac{3}{5} + \frac{1}{10}$

2. $\frac{6}{2} \times \frac{3}{4}$

3. $\frac{4}{5} \div \frac{1}{10}$

4. $\frac{13}{20} \div \frac{4}{5}$

Assessment tasks ----- LB page 62

Refer learners to Learner's Book page 62 for the questions.

Suggested homework

Simply.

1. $\frac{5}{6} \div \frac{2}{6}$

2. $\frac{20}{13} \times \frac{5}{8}$

3. $1\frac{1}{4} + 2\frac{1}{6}$

4. $\frac{1}{3} + \frac{2}{4} + \frac{1}{5}$

Activity 1: Review the previous lesson on the four operations with fractions with learners.

Activity 2: Ask learners to explain the four operations on decimals and percentages: addition, subtraction, multiplication and division.

Activity 3: Remind learners that to add or subtract decimals, they have to line up the decimal points and add or subtract just as we do for whole numbers. Add zeros if the decimals have different numbers of decimal points.

Examples

1. Add: $22.5 + 18.65$

$$\begin{array}{r} 22.50 \\ + 18.65 \\ \hline 41.15 \end{array}$$

2. Subtract 20.3 from 65.66.

$$\begin{array}{r} 65.66 \\ - 20.30 \\ \hline 45.36 \end{array}$$

Ask learners work in pairs to work out the answers.

3. $4.68 + 22.6$

4. $48.6 - 26.58$

Activity 4: Go through the worked examples on pages 63 to 66 in the Learner's Book with learners.

Review exercise

Differentiated lessons

Remedial activity

Put learners into mixed ability groups and ask them to work out the answers.

1. Add 30.68 to 22.05.

2. Subtract 19.68 from 27.5.

Assessment tasks ----- LB page 66

Refer learners to page 66 of the Learner's Book for the questions.

Suggested homework

1. Multiply 62.30 by 2.5.

2. $6.525 \div 0.5$

3. $68\% \times 2.5\%$

Answers to Assessment tasks

Main idea 1

(LB page 62)

- | | | | |
|----------------------|--------------------|----------------------|----------------------|
| 1. a. $3\frac{1}{4}$ | b. $1\frac{3}{10}$ | c. 3 | d. $3\frac{1}{3}$ |
| e. $1\frac{7}{12}$ | f. $\frac{1}{3}$ | g. $3\frac{1}{28}$ | |
| 2. a. $\frac{1}{6}$ | b. $\frac{5}{9}$ | c. $\frac{224}{255}$ | d. $\frac{3}{16}$ |
| e. $1\frac{9}{16}$ | f. $1\frac{1}{2}$ | g. $3\frac{1}{28}$ | |
| 3. a. 2 | | b. 5 | c. 10 |
| d. $\frac{13}{16}$ | | e. $1\frac{5}{9}$ | |
| 4. a. $\frac{1}{24}$ | b. $1\frac{1}{4}$ | c. $8\frac{9}{10}$ | d. $-1\frac{16}{39}$ |
| 5. 4 | | | |

Main idea 2

(LB page 66)

- | | | |
|--------------|------------|------------|
| 1. a. 18.7 | b. 3.978 | c. 0.00222 |
| d. 0.25 | e. 38.5 | f. 1.105 |
| 2. a. 1,800% | b. 90% | c. 41% |
| d. 800% | e. 890% | |
| 3. a. 8% | b. 3.3 | c. 4.4 |
| d. 0.000201% | e. 0.1066% | |

Sub-strand 3: Fractions, decimals and percentages**Module 2****Operations on fractions
BODMAS/PEMDAS****Content standard**

B9.1.3.1. Apply the understanding of operations on fractions to solve problems involving fractions of given quantities and round off the results to given decimal and significant places.

Indicator

B9.1.3.1 Add and/or subtract, multiply and/or divide given fractions, using the principle of order of operations including the use of the BODMAS or PEMDAS rule, and apply the understanding of these to solve problems.

Learning expectations: In this module, learners will learn how to:

- Use order of operations to simplify fractions.
- Solve word problems based on fractions.

Essential for learning: Learners can use the four operations to solve basic fraction questions.

Resources: Strips of paper, fraction chart

Keywords: fractions, BODMAS/PEMDAS

Competencies: Creativity and innovation, Personal development and leadership

Starter: Refer learners to page 67 of the Learner's Book for the starter activity.

Main idea 1

Order of operations on fractions

LB page 67

Activity 1: Review the previous lesson on decimals and percentages with learners. Ask them what they remember about how to solve problems with fractions using BODMAS/PEMDAS in Basic 8. Let them tell you what BODMAS/PEMDAS means.

Activity 2: Go through the guidelines for the order of operations with learners.

Guidelines for the correct order of operations on fractions:

- First, simplify parentheses in the expression.
- Simplify exponents in the expression.

- Multiply and divide before adding and subtracting.
- Multiply and divide from left to right in the expression.
- Add and subtract from left to right in the expression.

Activity 3: Put learners into convenient groups to simplify the following.

Simplify.

1. $\frac{1}{2} \times \frac{1}{4} - \frac{2}{5} \div \frac{16}{5}$

2. $\frac{12 - (18 \div 2)}{2 \times (6 + 4)}$

Activity 4: Go through the worked examples on pages 67 to 69 in the Learner's Book with learners.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Simplify this.

1. $2 \times \left(\frac{1}{2}\right)^2 + (6 + 4)$

Challenging activity

Ask learners to work in pairs to simplify the following.

1. Teacher Isifu spent $\frac{17}{20}$ of his salary on food and clothing. What fraction of his salary is left over?
2. $(3 + 4) \times \frac{1}{3} \div \frac{4}{5}$

Assessment tasks ----- LB pages 69–70

Refer learners to pages 69 to 70 of the Learner's Book for the questions.

Suggested homework

Simplify the following.

1. $\frac{1}{2} \times \frac{3}{4} - \frac{1}{4} \div 2\frac{1}{5}$

2. $\frac{3}{4} \div \frac{4}{3} \times \frac{1}{3}$

3. Given w as $\frac{2}{3}$, x as $\frac{1}{2}$ and z as $\frac{1}{5}$. Evaluate $wx + xz$.

Activity 1: Revise the previous lessons on BODMAS/PEMDAS with learners. Let them work in pairs. Each learner writes a question on any of the four operations on fractions for the other learner to solve.

Activity 2: Put learners into convenient groups. Refer them to main idea on page 70 of the Learner's Book. Let a learner read aloud the steps in solving word problems that include fractions.

Steps to follow when solving mathematics word problems:

1. Read the questions well and make sure you understand it.
2. Identify what the question asks you to do.
3. Write a mathematical sentences for the problem.
4. Solve the problem.

Activity 3: Put learners into convenient groups. Give each group a different question to solve. Let them exchange their work and check the other group's answers.

Activity 4: Still in their previous groups, go through the worked examples on pages 70 and 71 with them. Tell learners to work on their own to solve the last question.

Review exercise

Put learners into mixed ability groups to solve the following.

1. An end-of-year test is made up of 50 questions for 1 mark each. How many questions must a learner answer correctly to get 90%?
2. The price of a pencil is ₦1.50 and the price of a pen is ₦2.20. Calculate the total cost for 12 pencils and 10 pens.

Assessment tasks ----- LB page 71

Refer learners to page 71 of the Learner's Book for the questions.

Suggested homework

Solve these word problems.

1. What will be the length of a square if the area of the square is 64 cm?
2. The cost price of a fridge is ₦3,250.00. If it was sold for ₦3,050.00. By how much was the price reduced?
3. In an assembly election between two candidates Atta Amo and Baba Amuzu. Amo claimed he had 63% of the votes cast while Baba Amuzu also claimed he had 400 votes. If the total votes cast was 700, explain to your teacher why you think that the results are not valid.

Answers to Assessment tasks

Main idea 1

(LB pages 69–70)

1. a. $\frac{7}{15}$ b. $\frac{2}{35}$ c. $1\frac{2}{3}$
 d. $\frac{11}{14}$ e. $-\frac{5}{27}$
2. a. $1\frac{1}{4}$ b. $3\frac{1}{3}$ c. $-\frac{7}{24}$ d. $10\frac{1}{8}$
 e. $1\frac{1}{30}$ f. $1\frac{5}{11}$ g. $-1\frac{7}{39}$
3. $-4\frac{37}{56}$ 4. $2\frac{19}{49}$ 5. $14\frac{1}{16}$

Main idea 2

(LB page 71)

1. $\frac{3}{2}$ cm
2. 21 days
3. $3\frac{1}{4}$ hours
4. 44 learners
5. 105 kg
6. $\frac{13}{24}$
7. GH¢36,000.00

Answers to Revision

3

(LB page 72)

1. a. $1\frac{21}{40}$ b. $\frac{11}{28}$ c. $\frac{5}{14}$ d. $2\frac{7}{9}$
2. a. 2.7 b. 15 c. 0.6%
3. a. 0.0225 b. 0.96
4. a. 6.21 b. 0.6975 c. 3.757 d. 0.0001035
5. a. 0.5925 b. 0.0839 c. 0.0442
6. a. $2\frac{4}{15}$ b. $3\frac{5}{8}$ c. 1 d. $3\frac{11}{30}$
7. 13.4 litres
8. 19.7 kg
9. 8.75 m
10. 51
11. 90%

Sub-strand 4: Number: ratios and proportion**Module 1****Equations of proportional relationship****Content standard**

B9.1.4.1 Apply the understanding of ratio, rate and proportions to solve problems that involve rates, ratios, and proportional reasoning and use it to solve real-world mathematical problems.

Indicator

B9.1.4.1.1 Represent proportional relationships by equations.

Learning expectations: In this module, learners will learn how to:

- Write an equation to represent a proportional relationship.
- Draw and interpret graphs of proportional relationships.

Essential for learning: Learners can find proportions of given ratios and reduce ratios to their lowest terms.

Resources: Graph sheets

Keyword: proportional relationship

Competencies: Critical thinking and problem solving, Creativity and innovation, Personal development and leadership, Digital literacy.

Starter: Refer learners to page 73 of the learner's book for warming up activity.

Main idea 1

Representing proportional relationship with equations

LB page 73

Activity 1: In Basic 8, learners learnt about proportional relationship. In this lesson, they are going to use equations to represent proportional relationships. Put learners into convenient groups. Let them tell you what they know about proportional relationship. (It's a relation between two variables such that one variable is equal to a constant times the other variable. The constant represent the ratio between the two variables. This ratio, will be the same for every set of ordered pairs that represents the relationship.)

Activity 2: Ask learners how to represent a ratio in equation form. Write the equation on the board and explain to them $y = kx$ and $k = \frac{y}{x}$, where k is the constant ratio known as constant of proportionality. y is the dependent variable and x is the independent variable.

Activity 3: Ask learners to work in pairs. Demonstrate by working out one example on the board. Example: A cyclist rides 10 km in one hour. Write an equation that represents this proportional relationship. Ask learners the values and to give the variables.

Number of kilometers: $y = 10$

Time spent: $x = 1$

$$\text{So, } k = \frac{y}{x} = \frac{10}{1} = 10$$

Substituting $k = 10$ the equation becomes:

$$y = kx$$

$$y = 10x$$

Activity 4: In convenient groups go through the worked examples on page 74 in the Learner's Book with learners.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Complete the table and write an equation for the relationship.

x	1	2	3	4	5	6	7
y	6	12				36	42

Challenging activity

1. A tractor weeds 40 acres of land in 1 hour. Make a table of values to show that the relationship between the acres the tractor weeded and the time is a proportional relationship.
2. Write an equation for the relationship.

Assessment tasks ----- LB page 75

Refer learners to page 75 of the Learner's Book for exercise.

Suggested homework

1. If a car travels at a constant rate of 300 km in 6 hours, what is the constant rate of the car? Write an equation to represent the car's constant rate.
2. A motor bike travels at a constant rate, the motorbike travels 230 km in 3 hours. Find the constant rate and write an equation to represent the motorbike constant rate.

Main idea 2

Draw and interpret graphs of proportional relationships
LB page 76

Activity 1: Revise the previous lesson with learners.

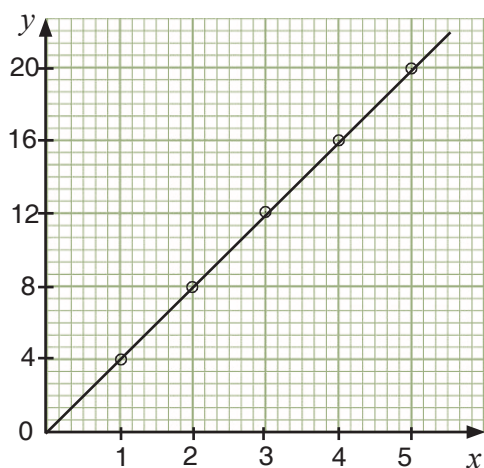
Activity 2: Put learners in convenient groups. Ask them to brainstorm and tell you what graph of proportional relationship is. (It is a straight line that passes through the origin.) Tell learners that the graphing proportional relationship between two variables is a relationship where the ratio between the two variables is always the same.

Activity 3: Write an example on the board. Example: Given $x = 1$ and $y = 4$, $\frac{y}{x} = \frac{4}{1} = 4$, draw a table for the relationship and plot it.

x	1	2	3	4	5
y	4	8	12	16	20

Activity 4: Guide learners to draw and plot the ordered pairs. They should work in pairs.

(1, 4), (2, 8), (3, 12), (4, 16), (5, 20)



Activity 5: Go through the worked examples on pages 76 to 78 in the Learner's Book with learners.

Review exercise

Differentiated lessons

Remedial activity

Draw the graph of the data in the table.

Determine if they are proportional and find the slope of the graph.

x	1	2	3	4
y	4	8	12	16

Challenging activity

Work in pairs. Complete the table below and draw it. Determine if the values are proportional and find the slope of the graph.

x	1	2	3	4	5	6
y	10	20		40		

Assessment tasks ----- LB pages 78–80

Refer learners to pages 78 to 80 of the Learner's Book for exercise.

Suggested homework

1. Dzifa a poultry farmer recorded the number of crates of eggs collected for in six days as shown below.
- b.** Complete the table

Days	1	2	3	4	5	6
Number of crates of eggs	15	30				90

- c. Graph the data.
- d. Use your graph or the table to work out how many crates of eggs she will collect in 9 days.

Answers to Assessment tasks

Main idea 1

(LB page 75)

- $k = 5$
 - $y = 5x$
- $y = -3x$

3.	Time (hours)	1	2	3	4	5
	Amount (GHC)	120	240	360	480	600

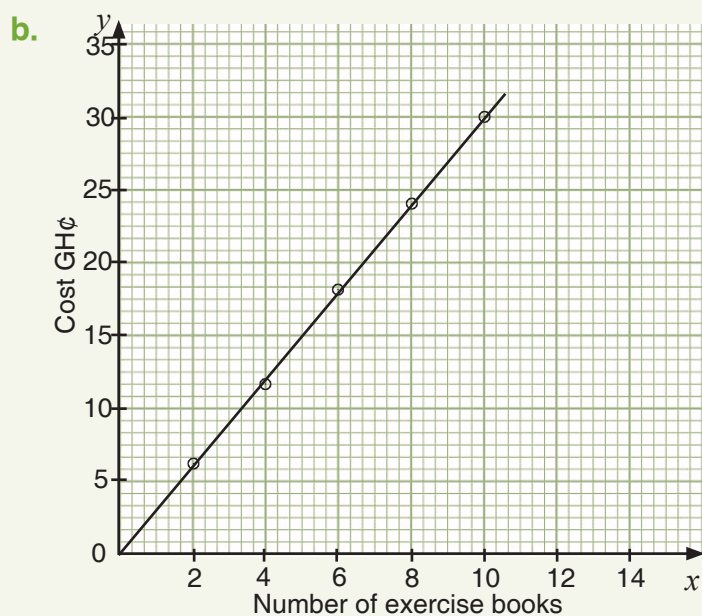
Equation: $y = 120x$

3. $k = \frac{126}{5}$; $y = \frac{126}{5}x$
4. 69 km per hour; $y = 69x$

Main idea 2

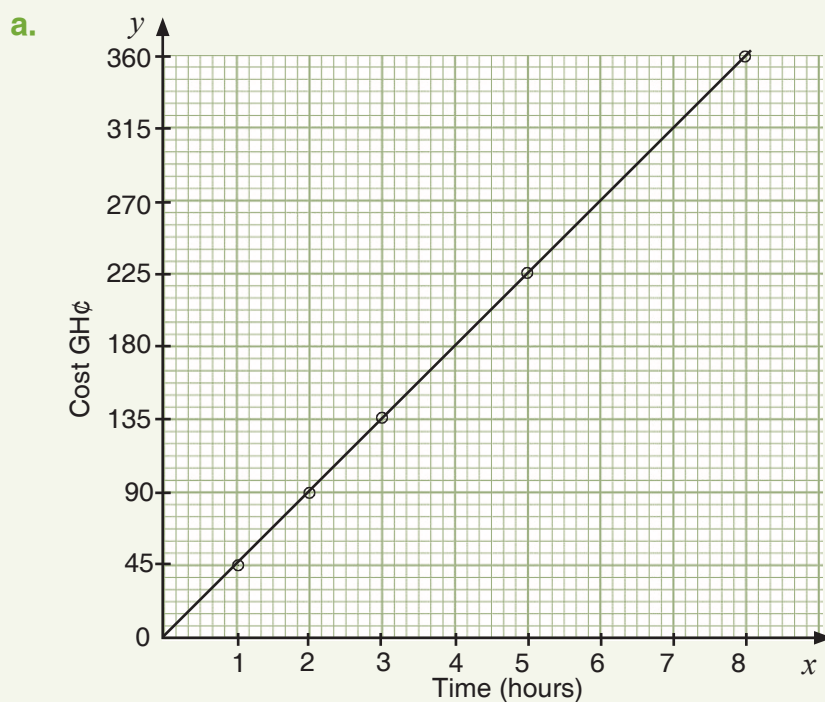
(LB pages 78–80)

- 1.**
- | | | | | | |
|-------|--------------------|-----|-----------|------|-----------------------|
| a. i. | GH¢3.00 per a book | ii. | GH¢18.00 | | |
| b. i. | 25 gallons | ii. | 9 minutes | iii. | 5 gallons per minutes |
- 2.**
- | | |
|----|---------|
| a. | $k = 3$ |
|----|---------|



c. GH¢3.00 for one exercise book

3. It is a proportional relationship. The ratio between each ordered pair is the same.



b. 6 hours

c. slope = 45

Sub-strand 4: Number: ratios and proportion**Module 2****Interest and taxes****Content standard**

B9.1.4.1. Apply the understanding of ratio, rate and proportions to solve problems what involve rates, ratios, and proportional reasoning and use it to solve real-world mathematical problems.

Indicator

B9.1.4.1.2 Use proportional relationships to solve multistep ratio and percentage problems, examples: simple interest, tax, discount and commissions, NHIL, depreciation, insurance, etc.

Learning expectations: In this module, learners will learn how to:

- Calculate simple and compound interest.
- Solve problems on taxes (VAT and NHIL).

Essential for learning: Learners can find percentages of given numbers.

Resources: Sentence cards, National Health Insurance cards

Keywords: simple interest, compound, interest, taxes

Competencies: Critical thinking and problem solving, Creativity and innovation, Personal development and leadership, digital literacy.

Starter: Refer learners to page 81 of the Learner's Book for quick mental drill.

Main idea 1

Solving problems on simple interest

LB page 81

Activity 1: Put learners into convenient groups. Let them brainstorm to find out what interest means. In real-life situations, they should be able to say what money lenders get from people who borrow money from them or banks get when they lend money to their clients. (They pay interest.) So, interest is an additional amount of money that is paid by a borrower to a lender or an investor.

Go through the worked examples on pages 82 in the Learner's Book with learners.

Activity 2: Take learners through how to calculate simple interest (SI). Explain the formula and work through a few examples on the board with learners.

$$SI = \frac{P \times R \times T}{100} \text{ where}$$

P = Principal

R = Rate

T = Time

The final amount to be paid is the principal amount plus the interest.

Activity 3: Put learners into convenient groups. Write an example on the board. Have learners work in pairs to solve it. Example: A trader borrows an amount of Gh¢5,000 from a credit union at a simple interest of 10% per annum for 2 years.

1. Calculate the interest.
2. Calculate the total amount that the lender will have to pay.

Solution

1. Principal (P) = GH¢5,000

Rate (R) = 10%

Time = 2 years

$$\begin{aligned} SI &= \frac{P \times R \times T}{100} \\ &= \frac{\text{GH¢}5000 \times 10 \times 2}{100} \\ &= 50 \times 10 \times 2 \\ &= \text{GH¢}1,000.00 \end{aligned}$$

∴ Interest is GH¢1,000.00

2. Amount paid = Principal + Interest

$$= 5,000 + 1,000.00$$

$$= 6,000.00$$

∴ The amount paid = GH¢6,000.00

Activity 4: Let learners exchange their work with the pair next to them, compare and discuss their solutions. Invite a group to present their work while the other groups check their answers and make corrections where necessary.

Activity 5: Go through the worked examples on pages 82 to 84 of the Learner's Book with learners.

Review exercise

Differentiated lessons

Remedial activities

Work in pairs.

Find the simple interest on a principal of GH¢500.00 when the rate is rate 5% and the time is two years.

Challenging activity

A company takes a simple interest loan of GH¢30,000.00 at a rate of 5%. What is the total amount the company will pay if the loan is for 5 years?

Assessment tasks ----- LB pages 84–85

Refer learners to pages 84 and 85 of the Learner's Book for the questions

Suggested homework

1. Calculate the compound interest on a loan of GH¢4,000.00 of a rate of 20% for 6 months.
2. At what rate will GH¢25,000.00 amount to GH¢50,000.00 in two years?

Main idea 2

Taxation

LB page 85

Activity 1: Put learners into convenient groups. Ask them to brainstorm to find the meaning of taxation and what they know about taxes. Ask a few groups to read aloud what they wrote to the class.

Activity 2: Through a questioning and answering session, help learners realise these facts:

- There are two types of tax: direct and indirect taxes.
- Direct tax is imposed on the income of an individual.
- Indirect tax is imposed on the sale of goods and services.
- Value-added tax (VAT) is a tax that is paid on goods and services. The rate of VAT is always given in a percentage.

Activity 3: Demonstrate by working through one example on the board.

Example: The VAT exclusive price of a refrigerator is GH¢2,500.00. If the VAT rate is 12%, find

1. the VAT charged
2. the VAT inclusive price

Solution:

1. $\text{VAT} = \frac{x}{100} \times A$, where A is the amount and x is the rate.

$$\text{So, } \frac{12}{100} \times 2,500 = 300$$

$$\therefore \text{the VAT charged} = \text{GH¢}300.00$$

2. The VAT inclusive price = GH¢2,500.00 + GH¢300.00
= GH¢2,800.00

Activity 4: Put learners into mixed ability groups and ask them to solve the following problem:

A customer bought items at a supermarket and paid GH¢3,500.00 with VAT of 15% inclusive.

1. What was the original price?
2. How much was the VAT?

Invite four groups to solve the on the board at the same time and ask the class which group's answer is correct.

Activity 5: Go through the worked examples on pages 85 and 86 with learners.

Review exercise

Differentiated lessons

Remedial activity

Ask learners to work in pairs to solve the problem:

A bill of GH¢1,000 with 15% VAT inclusive was put on an item. Calculate the VAT component.

Challenging activity

If 15% VAT was included for an item that cost GH¢5,500.00, answer the questions.

1. What was the price of the item?
2. How much was the VAT?

National Health Insurance (NHIL)

Activity 1: Ask learners to work in pairs. Let them talk about the National Health Insurance card using a think-pair-share strategy. Show samples to them. They should talk about the benefit as well. Call out a few learners to tell the class what they discussed.

Activity 2: In convenient groups, ask learners to talk about the NHIL levy/tax.

Through questioning and answering, elicit from them the percentage of the levy/tax. If they do not know the answer, explain the following to them:

The National Health Insurance Levy is a tax charged on goods and services for the provision of healthcare services in the country. It is collected under value-added tax (VAT). The rate is a $2\frac{1}{2}\%$ levy on goods and services.

Activity 3: Give each group problems to solve on sentence cards. Ask a group leader to write the solution on the board.

A radio set cost GH¢500.00 plus $2\frac{1}{2}\%$ NHIL

1. How much does the customer pay?
2. How much does the Government receive?

Solution:

1. Amount paid by the customer is $100\% + 2\frac{1}{2}\%$
 $= 102\frac{1}{2}\%$ of 500
 $= \frac{205}{200} \times 500$
 $= \text{GH¢}512.50$

$$\begin{aligned}
 2. \text{ Government share} &= \text{GH}¢512.50 - 500 \\
 &= \text{GH}¢12.50
 \end{aligned}$$

Activity 4: Refer learners to pages 86 and 87 of the Learner's Book. Go through the worked examples with them.

Review exercise

Differentiated lesson

Remedial activity

Work in groups of four to solve the problem. The NHIL-inclusive price of a television set is GH¢2,600.00. If NHIL is charged at the rate of $2\frac{1}{2}\%$. Find the cost of the television set.

Challenging activity

Work in pairs. The inclusive marked price of a refrigerator is GH¢5,200.00. If the NHIL charged rate is $2\frac{1}{2}\%$,

1. Find the cost of NHIL.
2. Calculate the price of the refrigerator.

Assessment tasks ----- LB page 88

Refer learners to page 88 of the learner's book for exercise.

Suggested homework

1. The VAT exclusive price of an item is GH¢6,400.00. If the VAT rate is $12\frac{1}{2}\%$. Find the VAT charged.
2. The NHIL inclusive price of a car is GH¢120,000.00. If the NHIL is charged at a rate of $2\frac{1}{2}\%$. Find;
 - a. The cost of the car.
 - b. The NHIL charged.

Answers to Assessment tasks

Main idea 1

(LB pages 84–85)

1. GH¢24.00
2. GH¢32,000.00
3. Interest = GH¢1, 500.00 Amount = GH¢16,00.00
4. $8\frac{1}{3}\%$
5. GH¢409.83
6. GH¢42,147.84

Main idea 2

(LB page 88)

- | | | | |
|-------|--------------|----|-------------|
| 1. a. | GH¢531.25 | b. | GH¢4,781.25 |
| 2. a. | GH¢3,050.67 | b. | GH¢381.33 |
| 3. | GH¢155.56 | | |
| 4. | GH¢60.98 | | |
| 5. a. | GH¢50.241.55 | b. | GH¢1,758.45 |
| 6. a. | GH¢3095.65 | | |
| | b. | | GH¢386.96 |
| | c. | | GH¢77.39 |

Sub-strand 4: Number: ratios and proportion**Module 3****Insurance, discount, commission, depreciation and SSNIT****Content standard**

B9.1.4.1. Apply the understanding of ratio, rate and proportions to solve problems that involve rates, ratios, and proportional reasoning and use it to solve real-world mathematical problems.

Indicator

B9.1.4.1.3 Use knowledge of rates and proportional reasoning to solve problems involving SSNIT benefits and contributions.

Learning expectations: In this module, learners will learn how to:

- Solve problems on discount, commission and depreciation.
- Solve problems on insurance and SSNIT.

Essential for learning: Learners can solve problems on simple interest and taxes.

Resources: SSNIT cards

Keywords: premium, insured, depreciate, discount, commission

Competencies: Critical thinking and problem solving, creativity and innovation, personal development and leadership, digital literacy

Starter: Refer to Learner's Book page 89 for the starter activity.

Main idea 1

Solving problems that involve discount, commission and depreciation **LB page 89**

Discount

Activity 1: Review the previous lesson with learners. Guide learners to understand what discount is through questioning and answering.

Example: I am selling a bag of maize for GH¢1,200.00. I sold it to a family member for GH¢1,000.00. By how much did I reduce the price? What percentage was the reduction in price?

Activity 2: Assess how well learners understand that discount is a reduction in the marked prices of goods and services. Giving discount is a strategy that is used to attract new customers to increase sales and to retain existing customers.

Calculating discount

Discount = list price – selling price

Discount rate (%) = $\text{discount} \div \text{list price} \times 100\%$

Activity 3: Put learners into convenient groups to solve some examples.

Example: Find the discount a woman will be given if she buys a trunk at GH¢320.00 while the selling price was GH¢410.00.

Activity 4: Go through the worked examples on page 90 in the Learner's Book with learners.

Commission

Activity 1: Deduce from learners through questioning and answering what a commission is. (A commission is the sum of money paid to an employee after completing a task that often involves selling an agreed number of products or services.)

Depreciation

Activity 1: Explain depreciation to learners by asking them the following questions.

1. Your mother bought a pair of shoes for you for GH¢150.00. You have worn the shoes for four years. How much will you charge if someone wants to buy the shoes from you?
2. You have a beautiful dress you bought for GH¢200.00. After wearing the dress for six years, for how much will you sell it? Get answers from different learners. Let them know that the value will decrease because the condition of the dress has depreciated. Accept all answers that are lower than the original price.

Activity 2: Depreciation is a reduction or decrease in the value of an asset over a period of time. If an item is used over a period of time, its value decreases or depreciates by a percentage of the original value.

Activity 3: Have learners to work in convenient groups to solve the problem that follows. The teacher may write your own question.

The price for a bicycle that cost GH¢500.00 was reduced by 10%.

1. Find the new price.
2. Find the amount by which the price was reduced.

Solutions:

Original value = 100% = GH¢500

Depreciation = 10%

1. New price = $100\% - 10\% = 90\%$

$$\text{New price} = \frac{90}{100} \times 500 = \text{GH¢}450.00$$

2. Amount by which the price was reduced
 $= 500.00 - 450.00 = \text{GH¢}50.00$

Ask learners to set their own questions and solve them. They should swap questions with the learner next to them and mark each other's work.

Activity 4: Go through the worked examples on pages 92 and 93 in the Learner's Book with learners.

Review exercise

Put learners into mixed ability groups and ask them to solve the problem:

The original value of an item was reduced by 15%. The new value of the item was GH¢15,200.00. What was the original value?

Assessment tasks ----- LB pages 93–94

Refer learners to pages 93 and 94 of the Learner's Book for the questions.

Suggested homework

1. Ante Adiza bought a refrigerator for GH¢3,600.00 and sold it for GH¢3,150.00.
Find the depreciation percentage.
2. What was the original price of an item that was sold for GH¢16,800.00 after a deduction of 20% for depreciation?

Main idea 2

Solving problems that involve insurance and SSNIT

LB page 94

Activity 1: Put learners into convenient groups to discuss what insurance is. Let them give examples of any insurance company they know. Let them exchange ideas with the class.

Activity 2: Refer learners to page 94 of the Learner's Book. Read Main idea 2 to learners and ask them the following questions.

1. What is insurance?
2. What is a premium?
3. What is insured value?

Ask learners to work in pairs and read through Main idea 2 on page 94 to find the answers.

Activity 3: Go through the worked examples on pages 94 and 95 in the Learner's Book with learners. In pairs, let them solve the question that follows or write one question on the board for them to solve.

Mr Adede insured his car and paid a premium of GH¢2,650.00. If the rate was 5%, calculate the insured value of the car.

Premium paid = 2,650.00

Insured value is equivalent to 100%.

5% = 2,650

$$\begin{aligned}\therefore 100\% &= \frac{100}{5} \times 2,650 \\ &= \text{GH¢}53,000.00\end{aligned}$$

Work on the board and let learners check whether their answer is correct and make corrections, if necessary.

Activity 4: Give out work cards with different questions to the groups to solve. Groups can then exchange their work and mark another group's answers.

Review exercise

Differentiated lessons

Remedial activity

The headmistress insured her house and paid a premium of GH¢38,620.00. If the rate was 10%, find the insured value of the house.

Challenging activity

Seidu insured his house against fire. The insurance fixed the rate at 6% of the value of the house. If the annual premium was GH¢4,500.00, calculate at how much the house was valued.

Assessment tasks ----- LB pages 105–107

Refer learners to learner's book pages 105 to 107 in the Learner's Book for the questions.

Suggested homework

1. A company's building was insured and an annual premium of GH¢20,900.00 was paid. If the insurance company fixed the rate at 12% of the value of the building, calculate the insured value of the building.
2. Mr. Asienim Ohene insured his car and paid a premium of GH¢6,288.00. If the insurance company fixed the rate at 7%, calculate the insured value of the car.

Main idea 3

Social Security and National Insurance Trust **LB page 95–96**

Activity 1: Find out what learners know about or have heard about (SSNIT). Explain to learners:

1. what SSNIT is
2. the law that governs SSNIT
3. the contribution rate.

SSNIT is the Social Security and National Trust Fund.

SSNIT is governed by the PNDC Law 247 and the National Pension Act 2008.

Contribution rate:

- A worker pays 5.5% of his/her basic salary.
- An employer pays 13% of a worker's basic salary, given a total of 18.5%.
- Out of the 18.5% paid to SSNIT, 2.5% is sent to the NHIA for the members' health scheme.

- The remaining 5% is sent to the mandatory second tier occupational scheme, which is a private scheme.

Activity 2: Discuss the PNDC Law 247 with the class. Explain to learners that under the PNDC law 247, the worker pays 5% of his/her basic salary and the employer pays 12.5% of the worker's salary, which gives a total contribution of 17.5% of the worker's salary.

Activity 3: Take learners through the worked examples on pages 96 to 98 of the Learner's Book.

Activity 4: Have learners work in pairs to solve this. Madam Ayeshetu is a government worker under Act 766 with a monthly salary of GH¢1,870.50. Calculate the following:

1. her employer's contribution
2. her contribution
3. the total contribution that is paid for her at the end of the month.

Solution

1. Under Act 766, the employer's contribution is 13%.

$$\text{So, } \frac{13}{100} \times 1,870.50 = \text{GH¢}243.17$$

2. Employee 's contribution = $\frac{5.5}{100} \times 1,870.50 = \text{GH¢}102.88$

3. Total monthly contribution = $243.17 + 102.88 = \text{GH¢}346.05$

Review exercise

Put learners into mixed ability groups to solve the problem: Mr Oppong Jnr's basic salary is GH¢4,520.20. Calculate his contribution to SSNIT under PNDC Law 247.

Assessment tasks ----- LB pages 105–107

Refer learners to pages 105 to 107 of the Learner's Book for the questions.

Suggested homework

Mr Nortey's basic salary is GH¢4,685.20. Calculate his contribution to SSNIT under both Act 766 and PNDC Law 247.

Main idea 4

Employees benefit from SSNIT under Act 766 and
PNDC LAW 247 **LB pages 98–99**

Activity 1: Review previous lesson on Social Security and National Insurance (SSNIT) with learners. Let them work in pairs to write one question on the laws and solve it.

Activity 2: Ask learners to tell you who qualifies for full pension. If they are not able to tell you, explain that to qualify for full pension, one must be 60 years old. Let them also know that to qualify, you might have contributed for 180 months (15 years) under Act 766 and 240 months (20 years) under PNDC Law 247.

Activity 3: Have learners work in convenient groups. Give each group a copy of the Mathematical and Statistical table. Explain the table clearly to learners and show them how to use it.

The tables that follow show the pension right for SSNIT contributions under Act 766 and PNDC LAW 247.

Act 766

Year of contribution	15	16	17	18	19	20	...
Pension right (%)	37.500	38.620	39.740	40.860	41.980	43.100	...

Year of contribution	30	31	32	33	34	35
Pension right(%)	54.300	55.440	56.540	57.660	58.790	60.000

PNDCL 247

Year of contribution	20	21	22	23	24	25	...
Pension right (%)	50.00	51.50	53.00	54.50	56.00	57.50	...

Year of contribution	31	32	33	34	35	...	40
Pension right (%)	66.50	68.00	69.50	71.00	72.50	...	80.00

Activity 4: Go through the worked examples on pages 99 and 100 in the Learner's Book with learners.

Activity 5: Have learners work in convenient groups. Write a question on the board for them to solve.

Example: Dede retired at age 60 years after contributing to the pension for 19 years. If her average best salary for three years (36 months) was GH¢25,000.00, calculate her full pension and monthly pension under Act 766.

Solution:

Dede's annual pension under Act 766:

Best salary for 36 months = GH¢25,000.00

Percentage for 19 years = 41.980%

$$\begin{aligned}\text{Annual pension} &= \frac{41.980}{100} \times 25,000 \\ &= \text{GH¢}10,495.00\end{aligned}$$

$$\begin{aligned}\text{Monthly pension} &= 10,495 \div 12 \\ &= \text{GH¢}874.58\end{aligned}$$

Revision exercise

Put learners into mixed ability groups to solve the problem.

Adamu Musa retired at age 60 after working for 25 years. His average best salary for three years was GH¢42,000.00. Calculate his full pension and monthly pension under each law:

1. Act 766
2. PNDC Law 247.

Suggested homework

Mrs Amuzu a SSNIT contributor retired at age 58. Her average best salary for three years was GH¢48,000.00. Calculate her full pension and monthly pension under each law:

1. Act 766
2. PNDC Law 247.

Main idea 5

Invalidity and survivor's benefit

LB pages 101–102

Activity 1: Put learners into mixed ability groups. Write a question on the board about the employees benefit from SSNIT under Act 766 and PNDC Law 274 for learners to solve.

Activity 2: Have learners brainstorm the meaning of invalidity. Explain that *invalidity* refers to when one can no longer work due to a disease, an illness or a disablement of a permanent nature.

Activity 3: Refer learners to page 101 of the Learner's Book. Go through the criteria or conditions for qualifying for the benefits.

Survivor's benefits

Activity 4: Let learners know that survivor's benefit is one-time payment. Go through the condition and how to calculate the benefit on pages 101 and 102 of the Learner's Book with the class.

Activity 5: Go through the worked examples on pages 103 to 105 in the Learner's Book with learners.

Activity 6: Put learners into convenient groups to answer the question: Dzodze, a contributor of SSNIT was rendered invalid after contributing to the fund for 18 years. If his best salary for three years was GH¢10,680.00, calculate the invalidity benefit he will receive. Allow some groups to present their solution to the rest of the class for discussion.

Review exercise

Have learners work in pairs to solve the problem that follows.

A woman contributed to the scheme for 240 months and she died at age 56. If she was paid GH¢50,000.00 each year for her three best years, calculate the survivor's benefits under Act 766.

Assessment tasks ----- LB pages 105–107

Refer learners to pages 105–107 of the Learner's Book for the questions.

Suggested homework

1. Mr Quansah contributed 11 years before he became an invalid. His best salary for three years (36 months) period was GH¢28,600.00. Calculate his invalidity benefit.
2. Mr Kekele contributed to the pension scheme for 300 months and he died at age 54. If his best annual salary for three years was GH¢50,000.00, calculate the survivor's benefits under **a)** Act 766 and **b)** PNDC Law 274.

Answers to Assessment tasks

Main idea 1

(LB pages 93–94)

1. GH¢39.00
2. a. GH¢54.60
b. GH¢101.40
3. a. GH¢1,250.00
b. GH¢1,250.00
4. GH¢28,400.00
5. 5.88%
6. 1%
7. GH¢23,040.00
8. GH¢6,141.25
9. GH¢27,258.88
10. GH¢2,880.10

Main idea 5

(LB page 105–107)

1.
 - a. GH¢2,100.00
 - b. More than the premiums
2. GH¢250,000.00
3. Under Act 766:
 - a. GH¢710.91
 - b. GH¢300.77
 - c. GH¢84.31Under PNDCL 247:
 - a. GH¢683.50
 - b. GH¢273.40
 - c. GH¢956.90
4. Employer's contribution = GH¢4,597.20
Monthly basic salary = GH¢3,060.80
5.
 - a. Pension under Act 766: GH¢19,797.75
 - b. Pension under PNDCL 247: GH¢23,668.75
 - c. Monthly pension under Act 766 - GH¢1,649.81
Monthly pension under PNDCL 247: GH¢1,972.40
6.
 - a. Under PNDCL 247:
Annual pension: GH¢16,300.95
Monthly Pension: GH¢1,358.41
 - b. Under Act 766:
Annual Pension - GH¢13,813.28
Monthly Pension - GH¢1,151.11
7. GH¢8,565.00

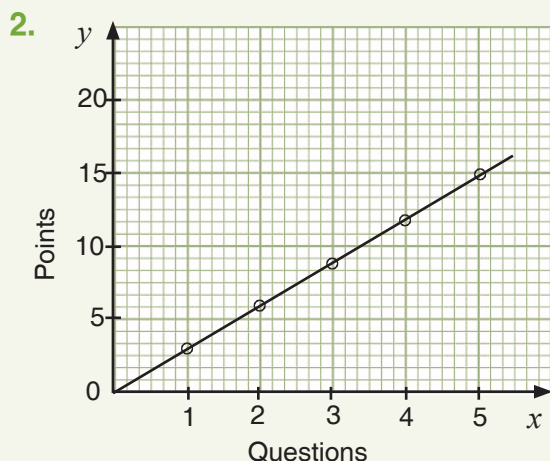
8. GH¢16,375.00
9. GH¢670,591.02

Answers to Revision

4

(LB page 108)

1. $P = 24 T$



3. GH¢14,000.00

4. GH¢15,518.00

5. GH¢15.60

6. a. GH¢4,800.00

b. GH¢600.00

7. a. GH¢63,043.00

b. GH¢7,880.00

c. GH¢1,576.09

8. 12.63%

9. GH¢25,000.00

10. Under Act 766

a. GH¢710.84

b. GH¢300.74

c. GH¢84.30

Under PNDCL 247

a. GH¢683.50

b. GH¢273.40

c. GH¢79.74

Sub-strand 1: Patterns and relations**Module 1****Graphs of linear relations****Content standard**

B9.2.1.1 Demonstrate the ability to construct tables of values for pairs of linear relations, graph the relations on a number plane and determine the intersection of the lines to solve simultaneous linear equations.

Indicator

B9.2.1.1.1 Construct a table of values for two linear relations and graph the relation.

Learning expectations: In this module, learners will learn how to:

- Construct a table of values and draw the graph of two linear equations.
- Use graphs of two linear relations to find missing elements in ordered pairs of relations.

Essential for learning: Learners can draw linear graphs.

Resources: Graph sheets

Keywords: variable, table of values, ordered pairs

Competencies: Critical thinking and problem solving, communication and collaboration, creativity and innovation, cultural identity and global citizenship.

Starter: Refer learners to the starter activity on page 110 in the Learner's Book.

Main idea 1

Constructing table of values for two linear relations and drawing the graph of the relation with it **LB page 110**

Activity 1: Let learners know that in their previous class, they learnt about linear equations. Ask them to tell you what they remember? What shape does it take?

Activity 2: Revise the following points with learners:

- A linear equation is an equation that has two variables.
- A linear equation gives a straight line when graphed.

Steps to follow when creating a table of values for an equation.

Step 1: Isolate one variable.

Step 2: Choose the values for the non-isolated variable.

Step 3: Substitute the values into the rewritten equation.

Step 4: Calculate the value of the isolated variable.

Activity 3: Discuss the main idea on page 110 with the class and work through the examples on pages 111 to 114 with learners.

Activity 4: Put learners into mixed ability groups. Write a question on the board and ask learners to draw a table to find the relations and draw the graph.

Example: Find the values for the relation $y = 2x - 1$.

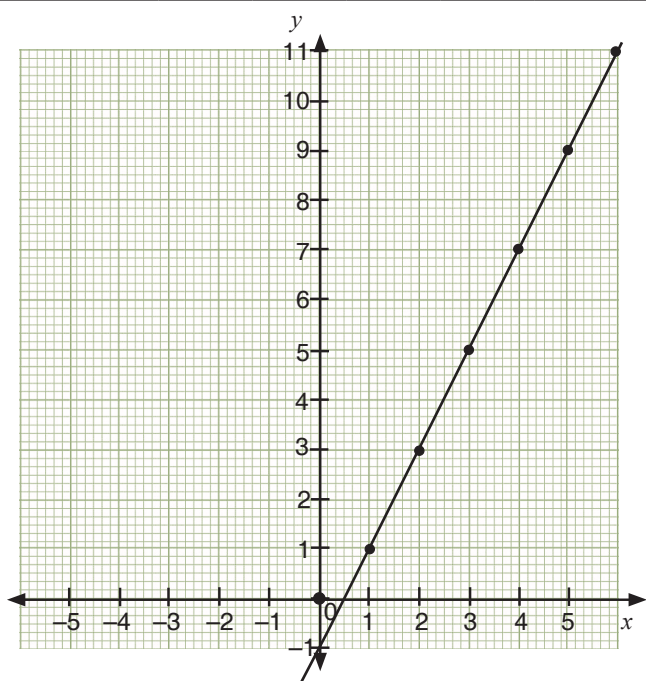
For $y = 2x - 1$, when x is 1, $y = 2 \times 1 - 1 = 1$

when x is 2, $y = (2 \times 2) - 1 = 3$

when x is 3, $y = (2 \times 3) - 1 = 5$

when x is 4, $y = (2 \times 4) - 1 = 7$

x	1	2	3	4	5	6
$y = 2x - 1$	1	3	5	7	9	11



Activity 5: Ask groups to swap their graphs and check the other group's graph. Ask a few groups to work on the board.

Review exercise

Differentiated lessons

Remedial activity

Ask learners to work in pairs.

Draw a graph for the relation, $y = 2x - 2$ for $-2 \leq x \leq 3$.

Challenging activity

Construct a table of values for the linear relations $y + 2x = -1$ and draw the graph.

Assessment tasks ----- LB pages 114–115

Refer learners to Learner's Book page 114 to 115 for exercise.

Suggested homework

1. Draw up a table of values for the relation $y = 2x - 1$, for $-2 \leq x \leq 3$.
2. Draw the graph for the relation. Use the graph to find two y -values.
 - a. y when $x = -1$
 - b. y when $x = 0$

Main idea 2

Finding missing elements in ordered pairs on graphs of linear relations
LB page 115

Activity 1: Ask learners to work in pairs to determine what an ordered pair is.

Explain to the class that when we draw the graphs of linear relations, we can use the graph to determine the missing elements in ordered pairs.

Activity 2: Refer learners to page 115 of the Learner's Book. Discuss the main idea with the class.

Activity 3: Go through the worked examples with learners on pages 116 and 117 in the Learner's Book. Ask learners to work in pairs.

Review exercise

Put learners into mixed ability groups and ask them to draw up a table of values for the relation $y = x - 1$, for $x = \{1, 2, 3\}$. Draw the graph.

Assessment tasks ----- LB pages 117–118

Refer learners to pages 117 to 118 of the Learner's Book for the questions.

Suggested homework

1. Copy and complete the table below of values for the relation in the table.

x	-1	0	1	2	3
$y = 2x - 1$	-3	-1		3	
$y = x - 2$	-3		-1		

2. Draw the graph of the above relations on the same axes.

Answers to Assessment tasks

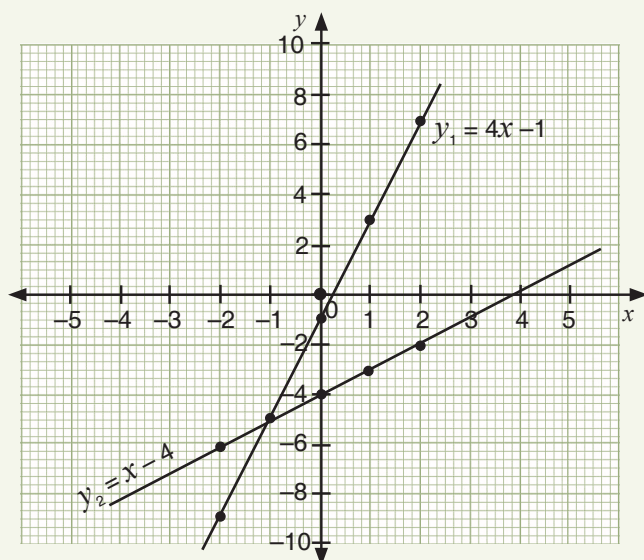
Main idea 1

(LB pages 114–115)

1. a.

x	-2	-1	0	1	2
$y_1 = 4x - 1$	-9	-5	-1	3	7
$y_2 = x - 4$	-6	-5	-4	-3	-2

b.

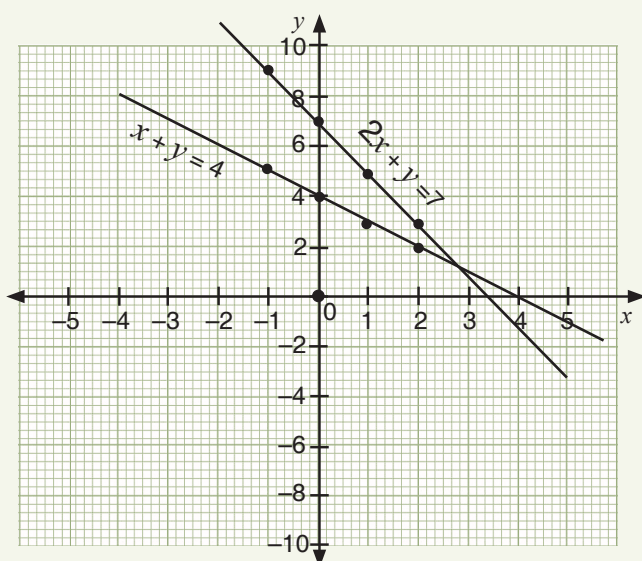


2. $2x + y = 7$

x	-1	0	1	2
y	9	7	5	3

$$x + y = 4$$

x	-1	0	1	2
y	5	4	3	2

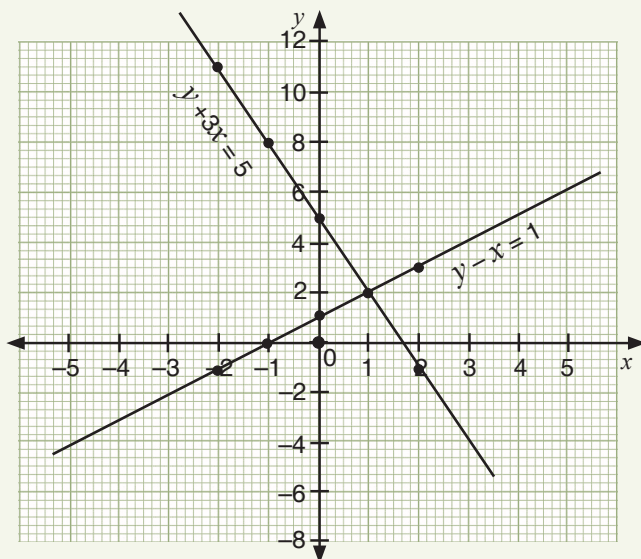


3. $y + 3x = 5$

x	-2	-1	0	1	2
y	11	8	5	2	-1

$y - x = 1$

x	-2	-1	0	1	2
y	-1	0	1	2	3

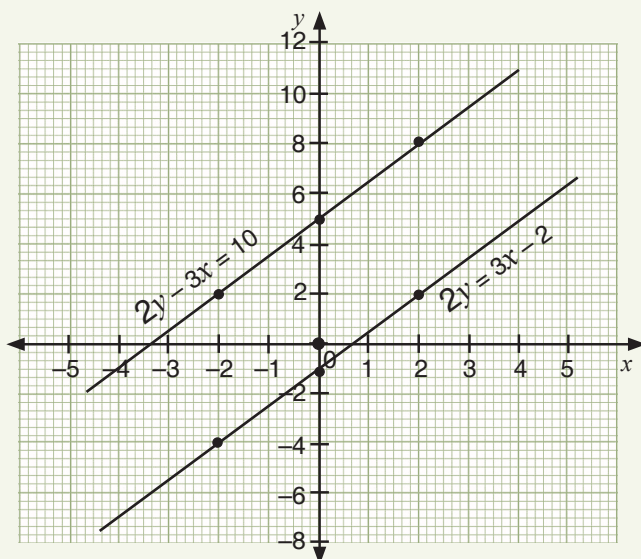


4. $2y = 3x - 2$

x	-2	0	2
y	-4	-1	2

$2y - 3x = 10$

x	-2	0	2
y	2	5	8



Main idea 2

(LB pages 117–118)

1. a. 20 seconds
- b. 75 metres

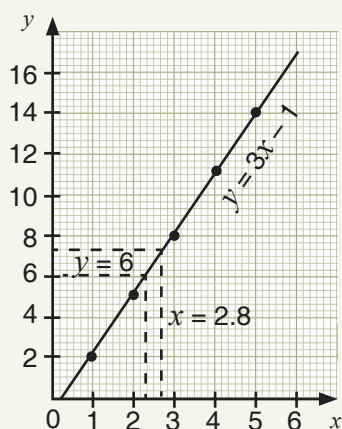
c.

Time (sec)	0	1	2	4	9	16
Distance (m)	0	5	10	20	45	80

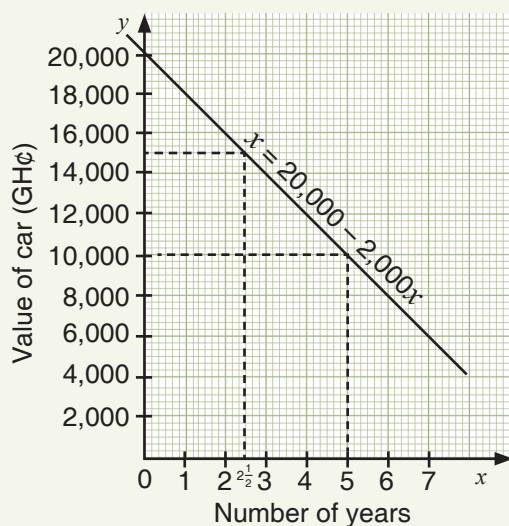
2. a. $y = 3x - 1$

x	1	2	3	4	5
y	2	5	8	11	14

- b. i. when $x = 2.8$, $y = 7.4$
- ii. when $y = 6$, $x = 2.3$



3. a.



- b. GH¢2,000.00
 - c. 5 years
 - d. GH¢15,000.00
4. a. 12 days
 - b. 64 cm

Sub-strand 1: Patterns and relations

Module 2

Equations of straight lines

Content standard

B.9.2.1.1 Demonstrate the ability to construct tables of values for pairs of linear relations, graph the relations on a number plane and determine the intersection of the lines to solve simultaneous linear equations.

Indicator

B9.2.1.1.3 Use graphs to solve equations involving two linear relations.

Learning expectations: In this module, learners will learn how to:

- Solve two linear equations simultaneously using graphs.
- Solve two linear equations using the elimination and substitution methods.

Essential for learning: Learners can draw graphs of linear equations.

Resources: Graph sheets

Keywords: simultaneous, elimination, substitution

Competencies: Creativity and innovation

Starter: Refer learners to page 119 of the Learner's Book for the starter activity.

Main idea 1

Using graphs to solve simultaneous equations **LB page 119**

Activity 1: Review the previous lesson on finding missing numbers for the graphs of linear relations with learners.

Activity 2: Explain what simultaneous equation is to learners.

Explain that a simultaneous equation involves two or more unknowns. Write an example of simultaneous equation on the board.

Example: $x + 2y = 6$ (Equation 1)

$x - y = 4$ (Equation 2)

Explain to learners how to solve simultaneous equations using graph. Learners need to identify the following:

1. Draw the two or more equations on the same axes.
2. Find the coordinates of the points where the lines intersect.

3. Write the values of the variables where the lines intersect as your answer.

Activity 3: Refer learners to page 120 of the Learner's Book. Go through the worked example with the class.

Activity 4: Have learners work in convenient groups to use graphs to find the answer to the simultaneous equations: $x + y = 6$ and $2x - y = 3$. You may use your own examples.

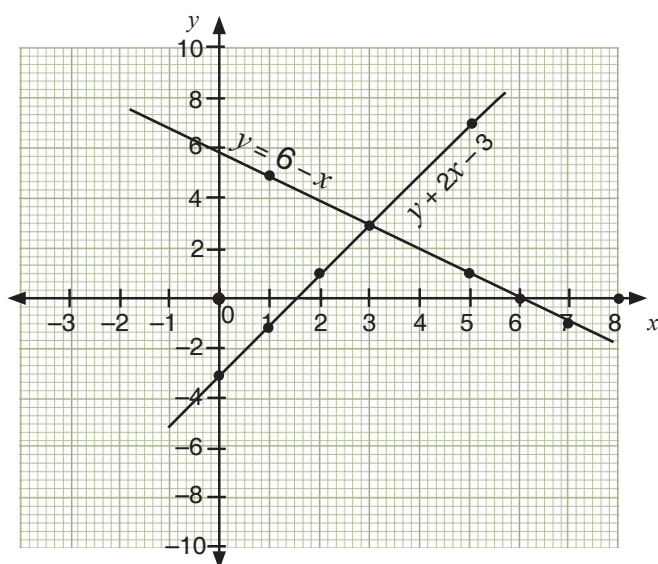
Ask learners to draw up tables for the two equations and plot the graphs.

$$y = 6 - x$$

x	1	3	5	6	7
y	5	3	1	0	-1

$$y = 2x - 3,$$

x	0	1	2	3	5
y	-3	-1	1	3	7



Review exercise

Put learners into convenient groups and ask them to draw the two graphs.

1. $y - 2x = 2$

2. $y + x = 4$

Assessment tasks ----- LB page 121

Refer learners to page 121 of the Learner's Book for the questions.

Suggested homework

Solve the two graphs simultaneous.

$$2x + y = 6 \text{ and } y - x = 3$$

Activity 1: Revise the previous lesson about solving simultaneous equations by drawing graphs with learners. Have them work in pairs.

Activity 2: Go through the steps for using substitution to solve simultaneous equations method with learners.

Steps for using substitution to solve simultaneous equations:

Step 1: Choose one of the equations and solve for one variable.

Step 2: Substitute the value for the variable from step 1 into the second equation.

Step 3: Solve the resulting equation, which will be an equation with one variable.

Step 4: Substitute the solution from step 3 into one of the original equations to find the other variable.

Step 5: Write the solution as an ordered pair.

Step 6: Check whether the ordered pair is a solution for both original equations.

Activity 3: Ask learners to work in pairs and go through the worked examples on pages 122 and 123 in the Learner's Book with them step by step.

Activity 4: In their previous groups, ask learners to solve one question on substitution. When they have finished, ask pairs to swap their work with the group next to them and mark the other group's work. Invite a few leaders to solve the problem on the board.

Examples:

$$2x + y = -1 \quad (\text{equation 1})$$

$$4x + 3y = 3 \quad (\text{equation 2})$$

$$\text{In equation (1) } y = -2x - 1 \quad \text{equation 3}$$

Substitute $y = -2x - 1$ in equation 2:

$$4x + 3(-2x - 1) = 3$$

$$4x - 6x - 3 = 3$$

$$= -2x$$

$$x = \frac{6}{-2}$$

$$= -3$$

Substitute $x = -3$ in equation 3:

$$y = (-2)(-3) - 1$$

$$y = 6 - 1$$

$$= 5$$

Activity 5: Write an example on the board for learners to solve using the substitution method. Put learners into mixed ability groups to use substitution to solve the equations:

$$y = x - 2 \text{ and } y = 6 - 2x.$$

Review exercise

Ask learners to work in pairs and use substitution to solve the equations:

$$3x + 2y = 10 \text{ --- (1) and } x + 2y = -10 \text{ --- (2)}$$

Assessment tasks ----- LB page 123

Refer learners to page 123 of the Learner's Book for the questions.

Suggested homework

Solve these, use substitution method.

1. $y - x = 4$ and $2y - 3x = 16$

2. $4x + 2y = 12$ and $2x + 2y = 2$

Main idea 3

Solving simultaneous equation using elimination

LB page 124

Activity 1: Revise the previous lesson with learners about using substitution to solve simultaneous equation.

Activity 2: Explain to learners that we can use another method to solve simultaneous equation.

Elimination means eliminating one of the two variables to obtain an equation in only one variable that is easy to solve. When you find the value for the one variable, substitute the value into one of the original equations and solve it to find the value for the other variable.

Activity 3: Put learners into convenient groups. Write an example on the board for learners to solve.

Example: Use elimination to solve the equations, $x + 2y = 12$ and $2x + y = 6$

$$x + 2y = 12 \quad \text{equation 1}$$

$$2x + y = 6 \quad \text{equation 2}$$

Multiply equation 2 by 2 so that the y will have the same coefficient.

$$4x + 2y = 12 \quad \text{equation 3}$$

Subtract equation 3 from equation 1 to eliminate y .

$$x - 4x + 2y - 2y = 12 - 12$$

$$-3x = 0$$

$$x = 0$$

Put $x = 0$ in equation 1

Let learners check whether the answer is correct by substituting $x = -3$ and $y = 5$ in one of the two equations.

$$0 + 2y = 12$$

$$y = 6$$

So, $(0, 6)$ is the solution, that is $x = 0$ and $y = 6$

Activity 4: Refer learners to pages 124 and 125 of the Learner's Book. Go through the worked examples with them.

Review exercise

Differentiated activity

Remedial activity

Ask learners to work in pairs.

Use elimination to find the values of x and y .

$$x + y = 6 \quad (\text{equation 1})$$

$$2x + 3y = 8 \quad (\text{equation 2})$$

Challenging activity

Work in pairs.

Use elimination to solve the simultaneous equations.

$$2x - y = 11 \quad (\text{equation 1})$$

$$x + 3y = 9 \quad (\text{equation 2})$$

Assessment tasks ----- LB page 125

Refer learners to page 125 of the Learner's Book for the questions.

Suggested homework

Use elimination method to solve these

1. $2x + 3y = 8 \quad (1)$

$$3x + 2y = 7 \quad (2)$$

2. $x + y = 12 \quad (1)$

$$3x + y = 4 \quad (2)$$

3. $y = -2x + 14 \quad (1)$

$$y = 4x + 2 \quad (2)$$

4. $y = 2x + 8 \quad (1)$

$$y = 12 - x \quad (2)$$

Answers to Assessment tasks

Main idea 1

(LB page 121)

1. **a.** $x = 2; y = 4$
- b.** $x = 6; y = -2$
- c.** $x = 0; y = 2$

2. **a.** $y - x = 4$

x	-1	0	2
y	3	4	6

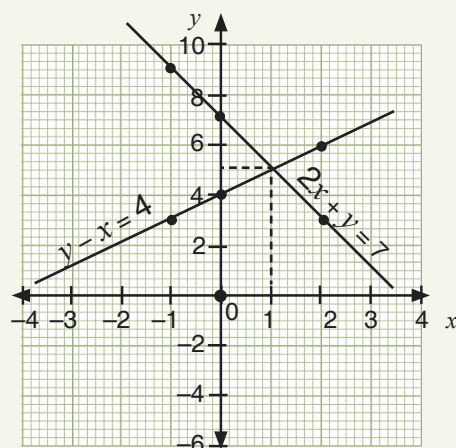
$$2x + y = 7$$

x	-1	0	2
y	9	7	3

- c.** Solution set $\{(x, y): x = 1, y = 5\}$

3. **a.** $\{(x, y): x = 2.5; y = 4\}$
- b.** $\{(x, y): x = 5; y = -4\}$
- c.** $\{(x, y): x = 4; y = -1\}$

b.



Main idea 2

(LB page 123)

1. $x = -3; y = 5$
2. $x = 6; y = 1$
3. $x = 2; y = 1.5$
4. $x = 4; y = -2$
5. 20

Main idea 3

(LB page 125)

1. **a.** $x = -6$
- b.** $y = 5$
2. **a.** $x = 7, y = -2$
- b.** $x = 2, y = 1$
- c.** $a = 5, b = -4$
- d.** 0

(LB pages 126 –127)

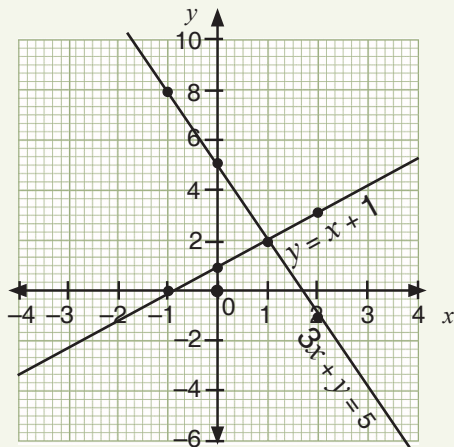
1. a. i. $y = x + 1$

x	-1	0	1	2
y	0	1	2	3

ii. $3x + y = 5$

x	-1	0	1	2
y	8	5	2	-1

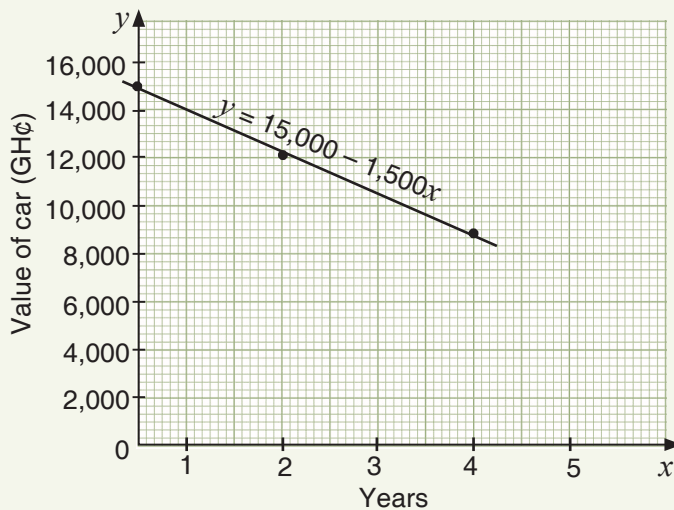
b.



2. a. $y = 15,000 - 1,500x$

Years (x)	0	1	2	3	4	5
Car value (GH¢) (y)	15,000	13,500	12,000	10,500	9,000	7,500

Graph showing the value of Fuseini's car



b. GH¢1,500.00

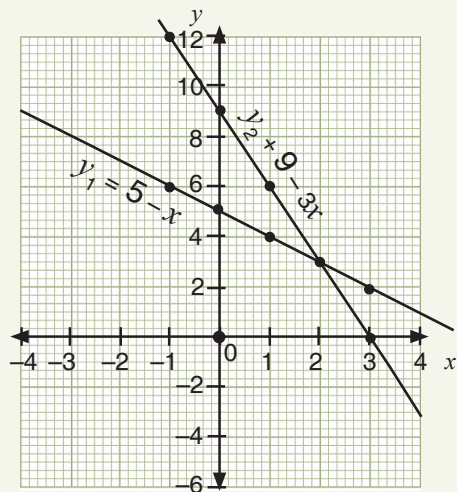
c. GH¢12,750.00

d. 5 years

3. a.

x	-1	0	1	2	3
$y_1 = 5 - x$	6	5	4	3	2
$y_2 = 9 - 3x$	12	9	6	3	0

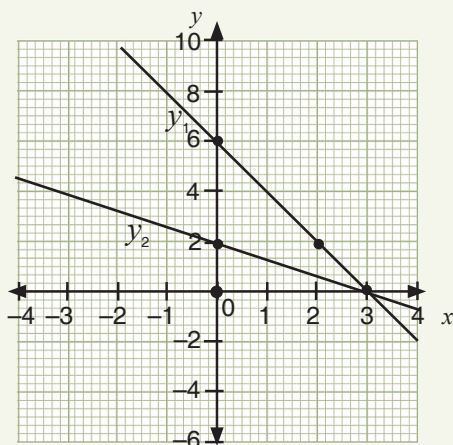
b.



c. (2, 3)

4. a. Let $y_1 = 6 - 2x$ and $y_2 = -\frac{2}{3}x + 2$

x	-1	0	1	2	3
$y_1 = 6 - 2x$	8	6	4	2	0
$y_2 = -\frac{2}{3}x + 2$	2.67	2	1.33	0.67	0



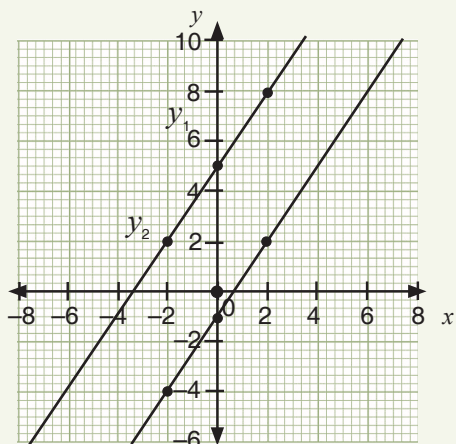
b. i. $\{(x, y): x = 3; y = 0\}$

ii. For $y + 2x = 6$, $y = 6$ and for $2x + 3y = 6$, $y = 2$

5. a.

x	-2	0	2	4
$2y_1 = 3x - 2$	-4	-1	2	5
$2y_2 - 3x = 10$	2	5	8	11

b.



c. i. Solution set = \emptyset

ii. For $2y_1 = 3x - 2$, $y_1 = \frac{1}{2}$ and for $2y_2 - 3x = 10$, $y_2 = 6\frac{1}{2}$

6. Check on learner's graphs:

$$x = 1, y = 2$$

Sub-strand 2: Algebraic expressions

Module 1

Substitution and change of formulae

Content standard

B9.2.2.1 Demonstrate an understanding of

- changing the subject
- substituting values to evaluate expressions
- factorising expressions that have a simple binomial as a factor.

Indicator

B9.2.2.1.1 Perform change of subject of a given formula and use it to solve problems.**Learning expectation:** In this module, learners will learn how to:

- Change the subject in given formulae.
- Use changing the subject to solve problems involving formulae.
- Substitute values into given formula to evaluate it and use it to solve problems.

Essential for learning: Learners can solve simultaneous equation using substitution.**Resources:** Sentence cards**Keywords:** formula, change subject, substitute**Competencies:** Critical thinking and problem solving, communication and collaboration, creativity and innovation, digital literacy**Starter:** Refer learners to the starter questions on page 128 in the Learner's Book.

Main idea 1

Changing the subject of formulae

LB page 128

Activity 1: Put learners into convenient groups. Let them brainstorm the concept of a formula and explain what a formula is. Ask different groups to contribute to a class discussion.**Activity 2:** Give the class the definition of a formula: A formula is a mathematical expression that shows how two or more quantities are related to one another. In a formula, the quantity that is represented by a letter or symbol that stands on its own, is called the *subject of the formula*.

The formula for simple interest is:

$$SI = \frac{P \times R \times T}{100},$$

SI is the subject of the formula.

To make the principal (P) the subject of the formula, we must solve for P by rearranging the formula in such a way that P becomes the subject.

Activity 3: Have learners work in pairs. Write the simple interest formula on the board and guide learners to make the principal (P) the subject of the formula.

$$\begin{aligned} SI &= \frac{P \times R \times T}{100} \\ &= I \times 100 = \frac{P \times R \times T}{100} \times 100 \quad (\text{Multiply both sides by 100.}) \\ &= I \times 100 = P \times R \times T \\ P &= \frac{1 \times 100}{R \times T} \quad (\text{Divide both sides by R and T.}) \\ \text{So, } P &= \frac{1 \times 100}{R \times T} \end{aligned}$$

Activity 4: Go through the worked examples with learners on pages 129 and 130.

Activity 5: Let learners make rate (R) and time (T) the subject of the formula. They should work in their previous groups.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Make C the subject of the formula $y = mx + c$.

Challenging activity

1. Make h the subject of the formula:

$$A = \frac{6t + 2h}{b}$$

2. Make m the subject of the formula: $T = \frac{m}{t_2} + c$

Assessment tasks ----- LB page 131

Refer learners to page 131 of the Learner's Book for the questions.

Main idea 2

Using change of subject to solve problems involving formulae
LB page 132

Activity 1: Put learners in convenient groups. Revise the previous lesson about changing the subject of formulae with learners.

Activity 2: Refer learners to page 132 of the Learner's Book. Read the main idea to learners. Place learners in pairs and ask them read in turns.

Activity 3: Put learners into convenient groups and guide them to solve the following problem.

Area of a rectangle: $A = L \times B$. Find the breadth if the area is 48 cm^2 and the length is 8 cm.

$$A = L \times B, A = 48 \text{ cm}^2, B = 8 \text{ cm}$$

$$48 = 8 \times B$$

Make B the subject of the formula by dividing both sides by L which is 8cm.

$$B = \frac{A}{L}$$

$$B = \frac{48}{8} = 6$$

So the breadth is 6 cm.

Activity 4: Go through the worked examples on pages 132 to 134 of the Learner's Book with learners.

Revision exercise

Differentiated lessons

Remedial activity

Work in pairs.

The area of a circle (A) is πr^2 . If the circumference is 22 cm and $\pi = \frac{22}{7}$, find the radius of the circle.

Challenging activity

The perimeter of a rectangle is 47 cm. If the length is 15 cm. What is the width of the rectangle?

Assessment tasks ----- LB pages 134–135

Refer learners to pages 134 and 135 of the Learner's Book for the questions.

Suggested homework

1. Find the length of a square if the area is 64 cm^2 .
2. The surface area of a closed cylinder is $A = 2\pi r^2 + 2\pi rh$. Find h (the height of the cylinder) if π is $\frac{22}{7}$ and $r = 14 \text{ cm}$.

Activity 1: Revise the previous lesson with learners. Put them into convenient groups and write a question on the board for learners to solve. Let them discuss their answers with the group next to them.

Activity 2: Write a question on the board and demonstrate how to solve it.

Find the value of $2(a - 3b) + 2(a - 3b)$ if $a = 3$ and $b = -2$.

Substitute: $a = 3$ and $b = -2$ in $2(a - 3b) + 2(a - 3b)$:

$$2(3 - 3(-2)) + 2(3 - 3(-2))$$

$$= (3 + 6)2 + 2(3 + 6)$$

$$= 9 \times 2 + 2 \times 9$$

$$= 18 + 18$$

$$= 36$$

Activity 3: Go through the worked examples on pages 135 to 137 of the Learner's Book with learners.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Given: $A = \pi r^2$.

If $\pi = \frac{22}{7}$ and $r = 7$ cm, find the value of A .

Challenging activity

Given that $A = \frac{1}{2h}(a + b)$, find the value of A when $h = 4$, $a = 6$ and $b = 2.5$.

Assessment tasks ----- LB pages 137–138

Refer learners to pages 137 to 138 of the Learner's Book for the questions.

Suggested homework

1. Find the value of $(x + 15y)^2$ when $y = 12$ and $x = 15$.
2. The formula for the surface area of a solid is given by $A = 6r(r + h)$. Make h the subject of the relation and hence find h if $A = 100$ and $r = 2$.

Answers to Assessment tasks

Main idea 1

(LB page 131)

1. $x = \frac{ab-c}{d}$ or $\frac{1}{d}(ab-c)$
2. $h = \frac{3v}{4\pi r^2}$
3. $a = \frac{2A-bh}{h}$ or $a = \frac{2A}{h} - b$
4. $y = \frac{5t-3z}{x+3}$
5. a. $x = \frac{1}{7}(3p+12)$
 c. $x = 2v - k$
 e. $x = \frac{4p-at}{t^2}$ or $x = \frac{1}{t^2}(4p+at)$
 g. $x = \frac{p-q}{r+1}$
6. a. $x = \frac{c+ry}{p}$ or $x = \frac{1}{p}(c+ry)$
 c. $x = (B-C)^2$
 e. $x = \sqrt{\frac{A+\pi y^2}{\pi}}$ or $x = \sqrt{\frac{A}{\pi} + y^2}$
 g. $x = \frac{ab}{a-b}$
7. a. $t = \frac{ck-b}{3}$ or $t = \frac{1}{3}(ck-b)$
8. $l = \frac{k^2}{4\pi^2}$
9. $y = \frac{5x}{p^2}$
10. $F = \frac{9}{5}c + 32$ or $F = \frac{1}{5}(9c + 160)$
- b. $x = \frac{ab-a}{8}$ or $x = \frac{a}{9}(b-1)$
- d. $x = \frac{c+d}{3a-b}$
- f. $x = \frac{3k-9kp}{y}$ or $x = \frac{3k(1-3p)}{y}$
- h. $x = \frac{p+qT}{m}$ or $x = \frac{1}{m}(p+qT)$
- b. $x = \sqrt{\frac{3v}{\pi h}}$
- d. $x = \frac{1}{q}(aq+py-bp)$
- f. $x = \frac{pq}{q+p}$
- h. $x = 2y - 6b$
- b. $t = \sqrt{\frac{2\pi l}{g}}$

Main idea 2

(LB pages 134–135)

1. 6 years
2. a. 44 cm b. 3.5 cm c. 6.29 m d. 0.4 m
3. a. $t = 15$ b. $u = 20$ c. $v = 17$
4. width = 8.5 cm
5. length = 41 cm
6. height = 13 cm
7. 24 sides

(LB pages 137–138)

- ## Mathematics

Sub-strand 2: Algebraic expressions

Module 2

Factorisation

Content standard

B9.2.2.1 Demonstrate an understanding of

- changing the subject
- substituting values to evaluate expressions, and
- factorising expressions that have a simple binomial as a factor.

Indicator

B9.2.2.1.2 Factorise expressions that have a simple binomial.**Learning expectations:** In this module, learners will learn how to:

- Factorise binomial expressions.
- Solve real-world problems involving factorisation and simplification.

Essential for learning: Learners can find the HCF of two or more numbers.**Resources:** Work cards**Keywords:** factorise, binomial, greatest common factor (GCF), identity**Competencies:** Critical thinking and problem solving, communication and collaboration, creativity and innovation, digital literacy.**Starter:** Refer learners to page 139 of the Learner's Book for the starter activity.

Main idea 1

Factorisation of binomial expressions

LB page 139

Activity 1: Revise the previous lesson on substitution of values in formulae with learners.**Activity 2:** Put learners in convenient groups. Ask learners to explain what a binomial expression means. Refer them to Main idea 1 on page 139 of the Learner's Book. Go through the notes with them.**Activity 3:** Let learners know that we can use the greatest common factor (GCF) if the terms in the binomial have a common factor. Write an example on the board and have learners factorise it. Example: $4x^2 + 6x$.The two terms have a greatest common factor of $2x$.So, $4x^2 + 6x$ as $2x(2x + 3x)$.

Activity 4: If both terms are perfect squares with a minus sign between them, we can use the identity for the difference of two squares to solve the binomial, for example:

$$a^2 - b^2 = (a + b)(a - b).$$

Example: Factorise $16x^2 - 9$ as $(4x + 3)(4x - 3)$.

Activity 5: Go through the worked examples on pages 140 and 141 with learners.

Revision exercise

Differentiated lessons

Remedial activity

Work in pairs.

Factorise the following binomials.

1. $10x^2 - 40x$

2. $12ab + 24bc$

Challenging activity

Factorise.

1. $2x - 5y - 2y^2 + 3y$

2. $12ab + 16b$

Assessment tasks ----- LB pages 141–142

Refer learners to pages 141 and 142 of the Learner's Book for the questions.

Suggested homework

Factorise the following binomial expressions.

1. $25x^2y - 30xy^2$

2. $8y - 2y^2$

3. $-13xy + 39x$

4. $3x + 4xy$

Main idea 2

Solving real-world problems involving factorisation and simplification

LB page 142

Activity 1: Revise the previous lesson on factorisation of binomials with learners.

Activity 2: Go through the steps to follow to solve real-life problems that involve factorisation and simplification on page 142 of the Learner's Book with learners.

Step 1: Carefully read the question and identify the unknown quantity.

Step 2: Represent the unknown quantity by a variable.

Step 3: Formulate an equation to use to find the values of variables.

Step 4: Solve the equation using any of the methods you have learnt.

Step 5: Check the answer to ensure that it makes sense.

Activity 3: Go through the worked examples on pages 143 and 144 of the Learner's Book with learners.

Activity 4: Pair learners and give out sentence cards with problems for learners to solve.

Example: The perimeter of a rectangular table is 80 cm. If the breadth is 2 cm less than the length, find the length and width of the table.

Guide learners to represent letters for the variables and write equation for the scenario.

Let x be the length of the table and $(x - 2)$ be the width.

$$\text{Perimeter} = 2l + 2w$$

$$x + x + (x - 2) + (x - 2) = 80$$

$$4x = 80 + 4$$

$$= 84$$

$$x = 21 = \text{length}$$

$$w = x - 2 = 21 - 2 = 19$$

So, $l = 21$ and $w = 19$.

Have learners compare their work with the calculation of the group next to them. Invite some group leaders to present their work to the class.

Review exercise

Differentiated lessons

Remedial activity

Ama went to the market and bought 20 items. She needs a plastic bag to carry the items home. How many bags will she need if each bag can take only four items?

Challenging activity

Work in pairs to solve the problem.

Amina bought two dozens of egg for GH¢20.00, three loaves of bread for GH¢5.00 each and five chocolates for GH¢8.00 each. How much did she pay for the items she bought?

Assessment tasks ----- LB page 145

Refer learners to page 145 of the Learner's Book for the questions.

Suggested homework

1. The length of a rectangle is twice as long as its width. If the perimeter is 90 m, find the area of the rectangle.
2. A man is now three times as old as his son. In 8 years' time, the sum of their ages will be 76. How old was the man when his son was born?

Answers to Assessment tasks

Main idea 1

(LB pages 141–142)

1. a. $9a(a + 2)$

b. $6xy(2x - 5)$

c. $5v(4u + 7w)$

d. $18xy^2 + 30xy = 6xy(3y + 5)$

e. $20p(2 + 5q)$

f. $4c(2c^2d + 3c)$

2. a. $3(2a + 3b)$ b. $5(2x + 3)$ c. $6(-3x + 2)$
 d. $15(2y^2 - 1)$ e. $y(1 + y)$ f. $7p(2p + 5)$
 g. $4a^2(a^2 - 3)$ h. $2ab(4b - 5)$ i. $u^7(6u^2 + 1)$
3. a. $2m(3m + 8)$ b. $5xy(5x^2 - 6y)$ c. $4x(-4 + 5x^2)$ d. $(x + 2)(x - 2)$
 e. $(2p + 3)(2p - 3)$ f. $(7a + 8)(7a - 8)$ g. $(8d + 5)(8d - 5)$
 h. $(1 + x)(1 - x)$ i. $(9p + 1)(9p - 1)$ j. $x^2 + 25$
4. a. $(x + 6)(x - 6)$ b. $3(x + 6)(x - 6)$ c. $2x(3x + 5)(3x - 5)$
 d. $(p + q)(a + b)$ e. $(c - d)(b + x)$ f. $(a + b)(a + b + c)$
 g. $(x + y)(x - y)$ h. $(3e + 2)(e - 2)$ i. $(a + b)(a + b - 1)$
 j. $(x + y)(r + 1)$

Main idea 2

(LB page 145)

1. Asamoah is 35 years old and Doe is 25 years
2. The numbers are 9, 10 and 11.
3. Area = 450 m^2
4. The numbers are 82, 84 and 86.
5. 15
6. Volume = 432 cm^3
7. $\frac{8}{11}$
8. Length = 13 cm, width = 5 cm
9. Gh¢18,000.00
10. The number is 11.
11. 30 years

Answers to Revision

6

(LB page 146)

1. a. $4a(3ab + 2d)$ b. $8xy(3x - y - 4)$ c. $(5q - r)(3p + 2q)$
 d. $(a + 2c)(b - 3d)$ e. $(9p + 11q)(9p - 11q)$ f. $8x(2x + y)(2x - y)$
2. a. $a = \frac{2A}{h} - b$ or $a = \frac{1}{h}(2A - bh)$ b. $h = \frac{2A}{a + b}$
3. $x = \frac{cy}{py - d}$ $y = \frac{dx}{px - c}$
4. a. 440 cm^2 b. 9 cm

5. 297 cm^2

6. a. $r = \frac{pq}{q-p}$

b. $-\frac{5}{6}$

7. GH¢6,360.00

8. 13 cm

9. 120 articles

10. GH¢932.50

Sub-strand 3: Variables and equations**Module 1****Linear inequalities****Content standard**

B.9.2.3.1 Demonstrate understanding of single variable linear inequalities with rational coefficients including: solving inequalities, verifying, comparing and graphing.

Indicator

B9.2.3.1.1 Solve single variable linear inequalities with rational coefficients.

Learning expectations: In this module, learners will learn how to:

- Solve single variable linear inequalities with rational coefficients and represent the solutions on number lines.
- Solve and graph linear inequalities on the Cartesian plane.

Essential for learning: Learners can solve linear equations problems.

Resources: Work cards, graph sheets

Keywords: Rational numbers, coefficient

Competencies: critical thinking and problem solving, personal development and leadership, digital Literacy

Starter: Refer learners to page 147 of the Learner's Book for mental exercise.

Main idea 1

Solving and graphing set of linear inequalities

LB pages 147–148

Activity 1: Review the previous lesson with learners. Remind learners that in Basic 8 they learnt about solving linear inequalities in one variable. Assess what learners remember and ask them to give examples.

Activity 2: Guide learners to revise the steps to follow to solve inequalities:

Step 1: Simplify both sides of the equation or inequality.

Step 2: Isolate the variable by adding, subtracting, multiplying, dividing or performing other functions with the same number on both sides of the equation or inequality.

Step 3: When solving inequalities, when you multiply or divide both sides of the inequality by a negative number, you need to change the direction of the inequality signs. (For example, less than (<) becomes greater than (>)).

Activity 3: Put learners into convenient groups and let them solve the following problem and draw a graph that shows the solution.

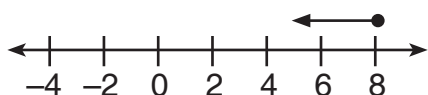
$$6x - 12 \leq 36.$$

$$6x \leq 36 + 12$$

$$6x \leq 48$$

$$x \leq 48 \div 6$$

$$x \leq 8$$



Activity 4: Take learners through the worked examples on page 148 to 150 of the Learner's Book.

Review exercise

Differentiated lessons

Remedial activity

Work in pairs. to solve the problems and draw a graph of each answer.

1. $3x + 6 > \frac{5}{6}x + \frac{5}{3}$

2. $\frac{1}{2} \geq x - \frac{1}{2}$

Challenging activity

Work in pairs. Illustrate each answer on a number line.

1. $\frac{3}{2}y - \frac{2}{5} \leq \frac{4}{5}$

2. $\frac{3y + 6}{10} < \frac{25 - 4y}{5}$

Assessment tasks ----- LB page 150–151

Refer learners to pages 150 and 151 of the learner's book for the questions.

Suggested homework

Find the truth set of these inequalities. Illustrate each answer on a number line.

1. $\frac{1}{2}(3x + 3) \leq x + 1$

2. $-\frac{2}{3x} + 3 \geq 0$

3. $\frac{1}{4}(5x - 4) < x + \frac{21}{12}$

4. $\frac{3x - 4}{4} < \frac{5x - 4}{6}$

Main idea 2

Solving and graphing linear inequalities on a Cartesian plane

LB page 151

Activity 1: Review the previous lesson about solving and graphing a set of linear inequalities with learners.

Activity 2: Read through Main idea 2 on page 151 with learners.

Go through these points with learners.

Steps to follow to graph a single variable linear inequalities on a Cartesian plane:

Step 1: Treat a $<$, $>$, \leq , \geq as an equation sign ($=$).

Step 2: Draw the equation as a dotted lines if it is $<$ or $>$.

Step 3: Draw the equation as a solid line if the inequality is \leq or \geq because points on the boundary line will satisfy the inequality sign.

Step 4: Pick a point not on the line and check if the point satisfies the inequality.

Step 5: Shade the region that satisfies the inequalities.

Activity 3: Go through the worked examples on pages 152 and 153 with learners.

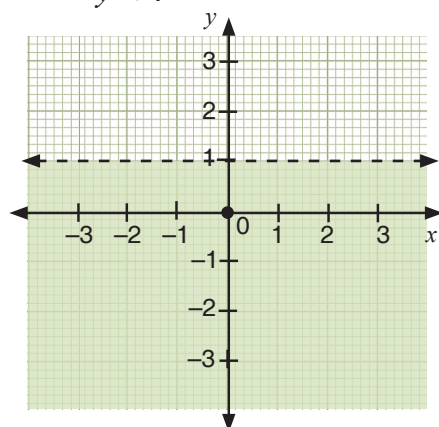
Activity 4: Put learners into convenient groups. Let them solve an inequality question and graph it. Example: Solve and graph the linear inequalities on a Cartesian plane.

$$5y + 3 < 6 + 2y$$

$$5y - 2y < 6 - 3$$

$$3y < 3$$

$$y < 1$$



Review exercise

Differentiated lessons

Remedial activity

Work in pairs.

Solve and graph the inequality $2x \geq 10$.

Challenging activity

Work in pairs.

Solve and graph the inequality $\frac{7x}{3} < 7$.

Refer learners to page 153 of the Learner's Book for the questions.

Suggested homework

Solve and graph these inequalities on a Cartesian plane.

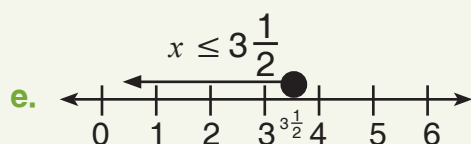
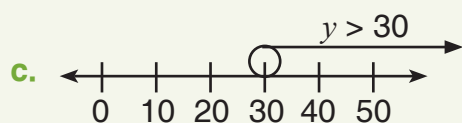
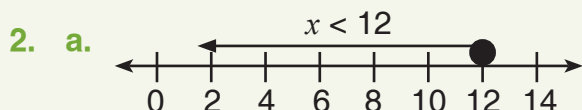
1. $10y + 6 < 18$
2. $3(x + 2) \geq 8$
3. $-4y - 16 \leq 24$

Answers to Assessment tasks

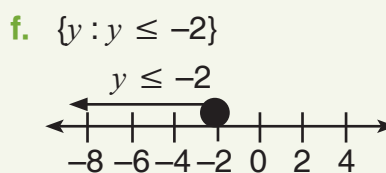
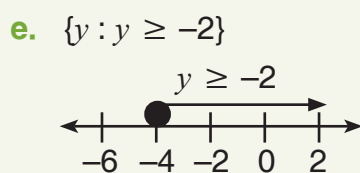
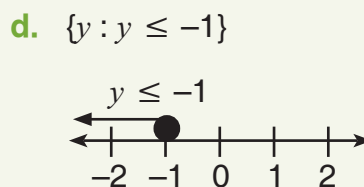
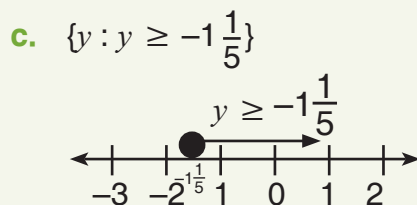
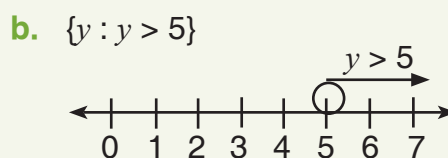
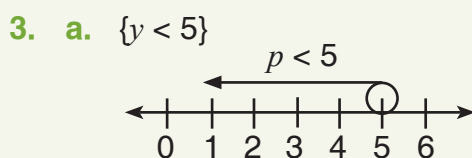
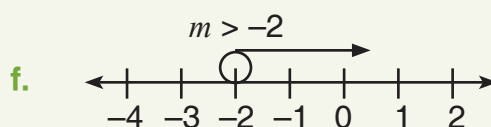
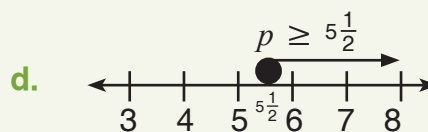
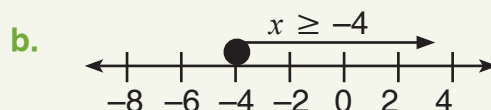
Main idea 1

(LB pages 150–151)

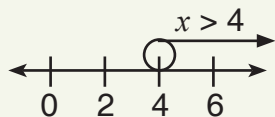
1. a. $y \geq 12$ b. $x < \frac{6}{5}$
e. $x < -3$ f. $y > 14$



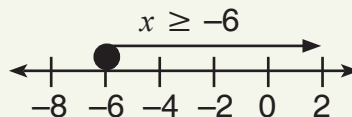
- c. $p < -\frac{11}{12}$ d. $x > 4$
g. $p \geq 7$ h. $m \geq \frac{3}{4}$



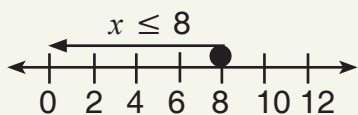
4. a. $\{x : x > 4\}$



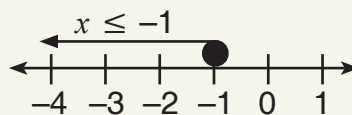
b. $\{x : x \geq -6\}$



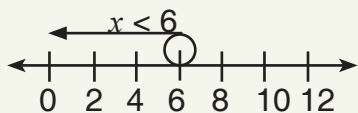
c. $\{x : x \leq 8\}$



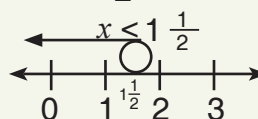
d. $\{x : x \leq -1\}$



e. $\{x : x < 6\}$



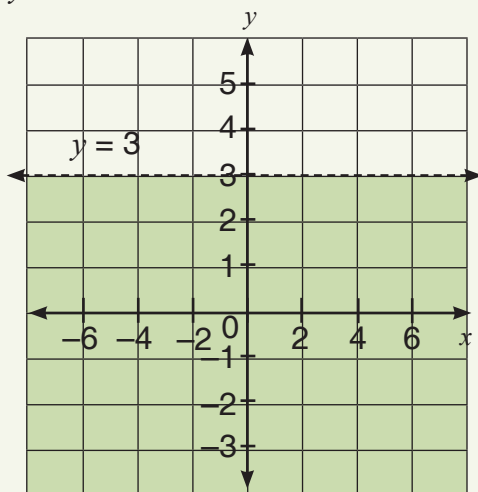
f. $\{x : x < 1\frac{1}{2}\}$



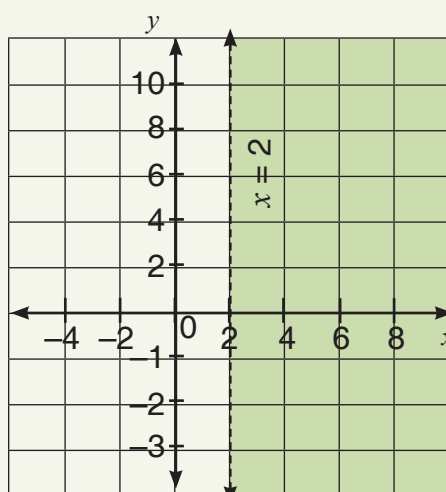
Main idea 2

(LB page 153)

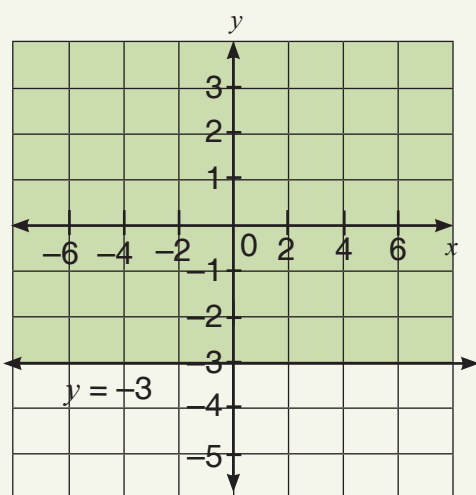
1. $y \leq 3$



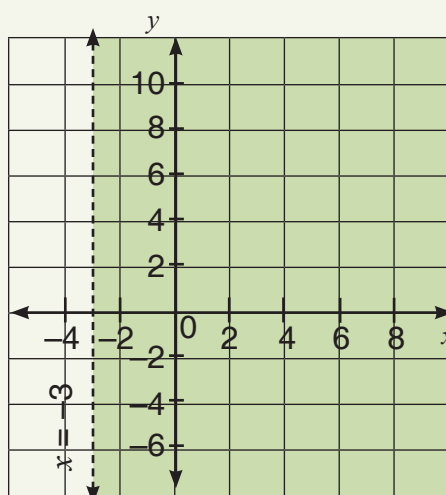
2. $x > 2$



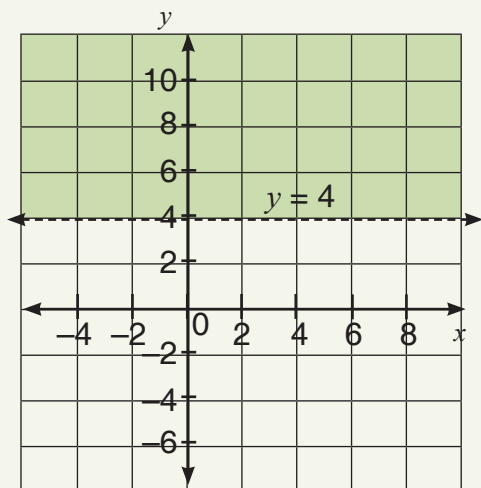
3. $y \geq -3$



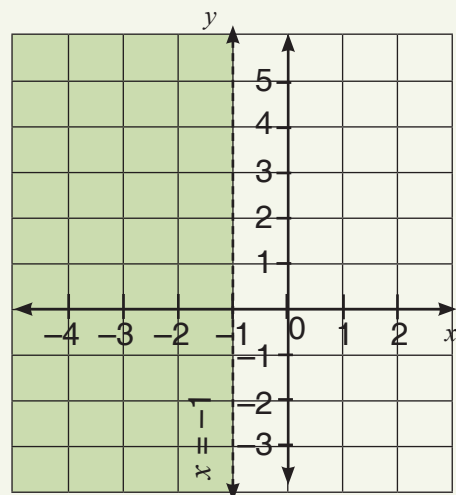
4. $x > -3$



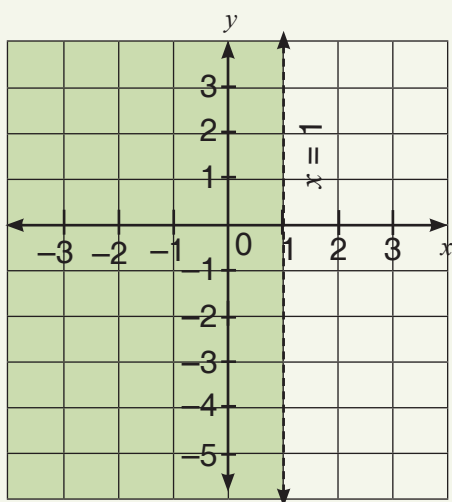
5. $y > 4$



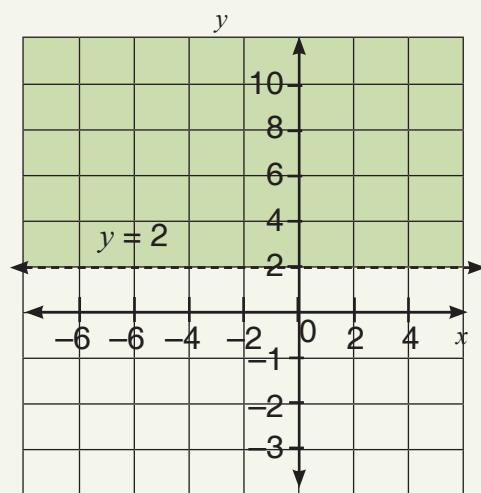
6. $x \leq -1$



7. $x < 1$



8. $y > 2$



Sub-strand 3: Variables and equations**Module 2****Real-life problems involving linear equations and inequalities****Content standard**

B9.2.3.1 Demonstrate understanding of single variable linear inequalities with rational coefficients including: solving inequalities, verifying, comparing and graphing.

Indicator

B9.2.3.1.3 Solve real-life problems involving linear equations and inequalities.

Learning expectations: In this module, learners will learn how to:

- Solve real-life problems involving linear equations.
- Solve real-life problems involving linear inequalities.

Essential for learning: Learners can solve and graph linear inequalities on a Cartesian plane.

Resources: Graph sheets

Keywords: linear equations, linear inequalities

Competencies: Critical thinking and problem solving

Starter: Refer learners to page 154 for in the Learner's Book for the starter activity.

Main idea 1

Solving real-life problems involving linear equations

LB page 154

Activity 1: Revise the previous lesson with learners.

Activity 2: Explain the strategies we use to solve linear equations and inequalities with learners by taking them through the following steps:

Step 1: Read the problems and identify the unknown quantity.

Step 2: Choose a variable to represent the unknown quantity.

Step 3: Write an equation for the variable you need to determine.

Step 4: Solve the equation using any strategy you have learnt to use.

Activity 3: Go through the worked examples with learners on pages 155 and 156 of the Learner's Book.

Activity 4: Put learners into convenient groups. Give work cards to each group to solve.

Example:

A farmer has 300 m of fencing. He wants to fence his farm, which has a rectangular shape with length of 60 m. Find the width of his farm.

Discuss with learners how they will solve the problem.

Let x be the width of the land.

$$x + 60 + x + 60 = 300$$

$$2x + 120 = 300$$

$$2x = 300 - 120$$

$$x = \frac{180}{2}$$

$$= 90 \text{ m.}$$

So, the width is 90 m.

Invite a few group leaders to explain to the class how to solve the problem.

Review exercise

Differentiated lessons

Remedial activity

Ask learners to work in groups of four to solve the problem:

The sum of two angles of a triangle is 135° and their difference is 45° . Find the sizes of the two angles.

Challenging activity

Work in pairs and solve the problem.

A rod is divided into two parts such that one part is 10 cm more than the other part. Find the length of the rod if the two parts are in the ratio 5 : 3.

Assessment tasks ----- LB pages 156–157

Refer learners to pages 156 and 157 of the Learner's Book for the questions.

Suggested homework

1. The perimeter of a rectangle is 60 m. If the length is twice the width, calculate the length and the width of the rectangle.
2. Emefa paid GH¢300.00 for 12 bags and a few pairs of shoes. If each bag cost GH¢20.00 and each pair of shoes cost GH¢15.00, how many pairs of shoes did she buy?

Main idea 2

Solving real-life problems involving linear inequalities

LB page 157

Activity 1: Review the previous lesson with learners. Let them tell you about the steps we use to solve inequalities. Tell learners that we use the same steps to solve inequalities.

Activity 2: Put learners in convenient groups. Solve one linear inequalities with learners. Let them set their own questions and solve them. Example: $2x + 3 \leq 19$

Activity 3: Go through the worked examples on pages 158 and 159 of the Learner's Book with learners.

Activity 4: In the same groups as for the previous activities, give groups cards problems for learners to solve.

A rectangle with length 20 cm has an area that is less than 90 cm^2 . How wide is the rectangle?

Review exercise

Put learners into mixed ability groups to solve the following problem.

A number is multiplied by 8, then 16 is subtracted from the result. The final answer is greater than or equal to 56. What is the range of numbers?

Assessment tasks ----- LB page 159–160

Refer learners to pages 159 and 160 of the Learner's Book for the questions.

Suggested homework

Two is subtracted from three times a number. The result is not more than twice that number added to 10. Find the possible range of numbers.

Answers to Assessment tasks

Main idea 1

(LB pages 156–157)

1. Shortest side = 18 cm; longest side = 30 cm
2. $\frac{4}{9}$
3. 80° and 55°
4. 350 km/h (inward) and 275 km/h (return)
5. 15 and 17
6. 2
7. Yaaba is 6 years old.
8. 23 learners
9. Adoley is 20 years old and Fatima is 12 years old.
10. 84 and 36

11. 100 people received GH¢50.00 notes and 50 received GH¢100.00 notes.

12. Length = 11 m; width = 5.5 m and area = 60.5 m^2

Main idea 2

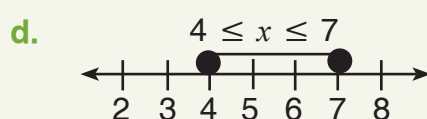
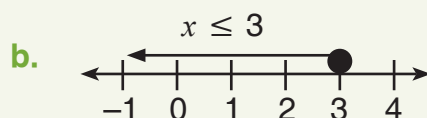
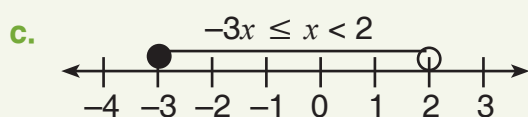
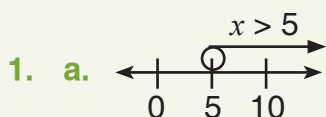
(LB pages 159–160)

1. The width is less than 5 cm.
2. Sales of more than GH¢1,200.00 per annum
3. More than 9,050 spectators
4. Maximum of 12 persons
5. 20 to 30 answers
6. Not more than 120 km
7. The number is greater or equal to 9.
8. GH¢1,125.00
9. 20 boxes
10. $x \leq 9$

Answers to Revision

7

(LB page 161)



- | | | | |
|--|---------------------|-----------------|---------------------|
| 2. a. $x \geq -3$ | b. $x < 2$ | c. $-4 < x < 2$ | d. $-5 \leq x < 10$ |
| 3. a. $y \geq 4$ | b. $x \geq 5$ | c. $x \leq 2$ | d. $x \geq 10$ |
| 4. $x = 12$ | | | |
| 5. a. $\{-2, -1, 0, 1, 2, 3, 4, 5\}$ | b. $\{1, 2, 3, 4\}$ | | |
| c. $\{3, 4, 5\}$ | d. $\{8, 9, 10\}$ | | |
| 6. 13 | | | |
| 7. The number is less than 3 | | | |
| 8. 7 | | | |
| 9. The number is not more than 5, so, $x \leq 5$. | | | |

Sub-strand 1: Shape and space

Module 1

Polygons

Content standard

B9.3.1.1.1 Apply the properties of angles at a point, angles on a straight line, vertically opposite angles, corresponding angles to solve problems.

Indicator

B9.3.1.1.1 Derive the formula for calculating the sum of angles in any polygon and use this to calculate the value of missing angles in polygons.

Learning expectation: In this module, learners will learn how to:

- Identify the various polygons and derive the formulae for calculating the sum of the angles in a polygon.
- Find the interior and exterior angles of polygons.

Essential for learning: Learners can construct triangles and measure angles.

Resources: Mathematical set

Keywords: polygon, exterior angle, interior angle

Competencies: Communication and collaboration

Starter: Refer learners to Learner's Book page 163 for the starter activity.

Main idea 1

Finding the sum of angles in polygons

LB page 164

Activity 1: Let learners know that they have learnt about polygons in their previous class. Assess what learners remember about polygons. Draw the following polygons on the board and ask learners to describe each one.

1.



2.

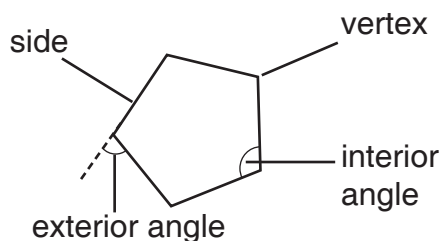


3.



Learners should give the number of sides and the number of angles in each polygon.

Activity 2: Polygons have as many angles or vertices as they have sides. Each vertex (angle) has a certain size (measured in degrees). Angles can be interior or exterior.



Activity 3: Refer learners to page 165 of the Learner's Book. Ask them to identify the exterior angles and the sum angles of a shape's exterior angles.

Activity 4: Discuss the solutions on pages 166 and 167 in the Learner's Book with the class.

Activity 5: Guide learners to deduce the formula for finding the exterior angle of a rectangle thus, $\frac{360^\circ}{n}$ where n is the number of sides.

Activity 6: Put learners into convenient groups. Go through the worked examples on page 168 of the Learner's Book with learners.

Review exercise

Differentiated lessons

Remedial activity

Have learners work in pairs.

One angle in a regular polygon is 60° . How many sides does the polygon have?

Challenging activity

Work in pairs.

How many sides does a regular polygon have if the sum of its angles is $1,440^\circ$?

Assessment tasks ----- LB pages 169–170

Refer learners to page 169 to 170 Learner's Book for the questions.

Suggested homework

1. A regular polygon has 10 sides. Find
 - a. The interior angle
 - b. The exterior angle
2. The sizes of the exterior angles of a four-sided figure are x° , $(x + 10^\circ)$, $(x + 15^\circ)$ and $(x + 20^\circ)$. Find the value of x .

Answers to Assessment tasks

Main idea 1

(LB pages 169–170)

1. 6 sides
2. 4 sides
3. $x = 114^\circ$
4. The polygon has 20 sides and classified as an icosagon.
5.
 - a. $x = 26^\circ$
 - b. $x = 10^\circ$
 - c. $x = 50^\circ$
 - d. $x = 50^\circ$
 - e. $x = 37.5^\circ$
6.
 - a. 30°
 - b. 150°
 - c. $1,800^\circ$
7. $x = 51^\circ$
8. $x = 30^\circ$
9. 7 sides
10. $y = 80^\circ$

Sub-strand 1: Shape and space

Module 2

Similar and congruent triangles

Content standard

B9.3.1.1 Apply the properties of angles at a point, angles on a straight line, vertically opposite angles, corresponding angles to solve problems.

Indicator

B9.3.1.1.2 Identify similar and congruent triangles and use the knowledge to solve related problems.

Learning expectations: In this module, learners will learn how to:

- Identify similar and congruent triangles and use this information to solve problems.

Essential for learning: Learners can identify different types of triangles. Example: equilateral and isosceles triangles.

Resources: Mathematical set

Keywords: similar, congruent

Competencies: Critical thinking and problem solving, creativity and innovation.

Starter: Refer learners to page 171 of the Learner's Book for the starter exercise.

Main idea 1

Similar and Congruent triangles

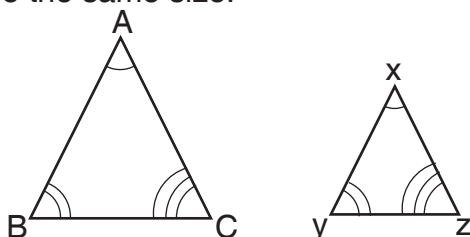
LB page 171–172

Similar triangles

Activity 1: Review the previous lesson about finding the sum of the angles in polygons with learners.

Activity 2: Put learners into convenient groups. Remind learners that two triangles are similar if they have the same shape, but their sizes may be different.

Construct two similar triangles on the board as shown below and use arcs to show which angles are the same size.



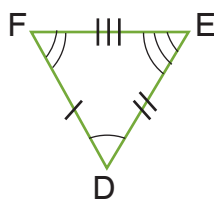
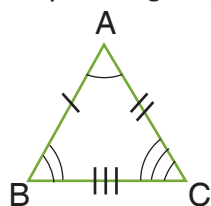
Activity 3: Refer learners to pages 171 and 172 in the Learner's Book. Go through Main idea 1 with them.

Activity 4: Go through the worked examples on pages 173 to 176 of the Learner's Book with learners.

Congruent triangles

Activity 1: Put learners into mixed ability groups. Ask learners what they know about congruent triangles.

Congruent triangles are triangles that have the same shape, the same side lengths and corresponding angles that are equal.



$\triangle ABC$ is congruent to $\triangle DEF$

Write the symbol on the board and ask learners to write it in their jotters: \cong

Activity 2: Refer learners to page 175 to 178 of the Learner's Book. Go through the worked examples with them. Ask learners to read through the conditions for triangles to be congruent.

Review exercise

Put learners into mixed ability groups to solve the problems.

Given that $\angle ABC = (x + 30)^\circ$, $\angle PQR = 40^\circ$ and $\angle RPQ = 60^\circ$, answer the questions.

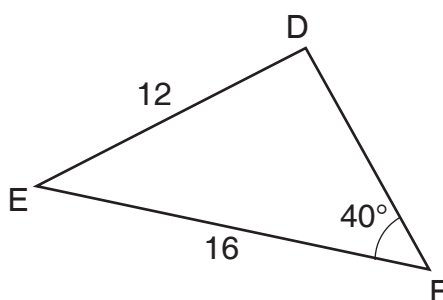
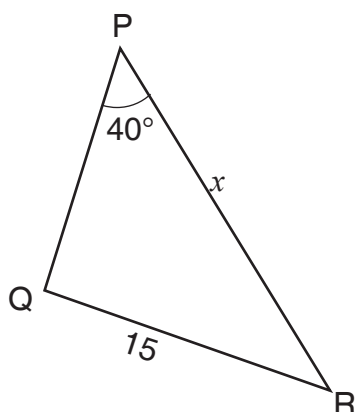
1. Draw the two triangles.
2. Find the value of x .

Assessment tasks ----- LB pages 179–181

Refer learners to pages 179 to 181 of the Learner's Book for the questions.

Suggested homework

1. Find the value of x given that $\triangle PQR$ is similar to $\triangle FDE$.



2. Given $AB = PR = 4$ cm, $BC = PQ = 7$ cm, $AC = QR = 5$ cm. Check whether triangles ABC and PRQ are congruent.

Answers to Assessment tasks

Main idea 1

(LB pages 179–181)

1. $\triangle PQR$ and $\triangle SUR$ are similar because $\angle Q = \angle u$, $\angle P = \angle S$ and $\angle PRQ = \angle URS$.
2. a. $\triangle PQT$ and $\triangle PRS$ are similar. The corresponding sides are: QT and RS; PQ and PR; PT and PS
b. $TS = 4$ cm
3. $x = 2$
4. $BC = 4$ cm, $EF = 21$ cm
5. $x = 5.4$ mm
6. $x = 5$
7. Two sides and an included angle
8. $x = 25^\circ$
9. $x = 17^\circ$
10. $\triangle ABC$ and $\triangle ADC$ are congruent.
 $AB = DC$ and $BC = AC$ is common. Or, right angle $\angle B = \angle D$ and the hypotenuse AC is common to both triangles and the other sides are equal.
11. $x = 20^\circ$ and $\angle LNM = 65^\circ$

Sub-strand 1: Shape and space

Module 3

Construct inscribed and circumscribed circles for triangles and parallelograms

Content standard

B9.3.1.1 Construct inscribed and circumscribed for triangles and parallelograms with given dimensions.

Indicator

B9.3.1.1.2 Draw inscribed and circumscribed circles for triangles under given conditions.

Learning expectation: In this module, learners will learn how to:

- Construct inscribed and circumscribed circles for triangles.
- Construct inscribed and circumscribed circles for parallelograms.

Essential for learning: Learners can construct circles and triangles with given radii and lengths, respectively.

Resources: Mathematical set

Keywords: inscribe, circumscribe, incentre, circumcentre, locus, equidistant

Competencies: Critical thinking and problem solving, communication and collaboration, creativity and innovation, personal development and leadership, digital literacy

Starter: Refer learners to page 182 of the Learner's Book for the starter question.

Main idea 1

Inscribed and circumscribed circles for triangles

LB pages 182–183

Inscribed circle in a triangle

Activity 1: Ask learners to work in pairs. Refer them to Main idea 1 on pages 182 and 183 of the Learner's Book. Let them go through the steps for constructing an inscribed circle in a triangle.

Steps

Step 1: Draw the triangle.

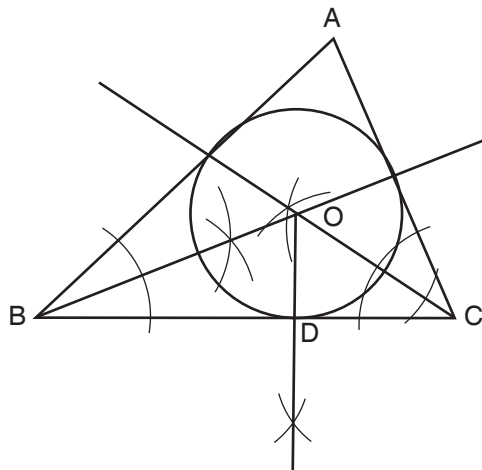
Step 2: Bisect any two or all three angles in the triangle. The bisecting lines will intersect at the centre.

Step 3: Draw a perpendicular line to one side from the intersection of the lines to touch the side at a point.

Step 4: With centre and the radius, draw an inscribed circle.

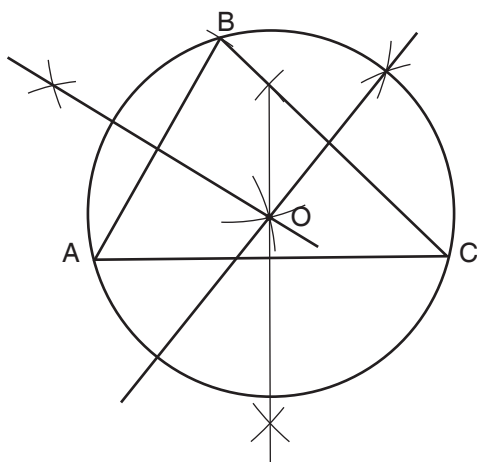
Activity 2: Pair learners. Demonstrate the steps to learners by drawing an inscribed circle on the board as learners also construct inscribed circles.

Activity 3: Have learners to construct an inscribed circle.



Circumscribed circle for a triangle

Activity 1: Put learners into convenient groups. Demonstrate how to construct a circumscribed circle for a triangle on the board by constructing the example below. Learners must watch and also construct circumscribed triangles.



Activity 2: Go through the worked examples on pages 184 to 188 of the Learner's Book with learners.

Review exercise

Ask learners to work in pairs. Using a ruler and a compass only, construct $\triangle ABC$ such that $AB = 8 \text{ cm}$, $\angle ABC = 60^\circ$ and $\angle BAC = 30^\circ$. Locate point O inside $\triangle ABC$ such that it is equidistant from AB, BC and CA.

Construct the inscribed circle.

Assessment tasks ----- LB page 189

Refer learners to page 189 of the Learner's Book for the questions.

Activity 1: Put learners into convenient groups. Revise with learners the qualities of a square and a rectangle and the differences between the two shapes. Let them draw each shape in their jotters.

Activity 2: Demonstrate how to construct a square and rectangle on the board for learners to watch and then construct the two shapes in their books. Refer them to pages 189 and 190 of the Learner's Book. Go through the steps with them.

Steps to construct a square:

Step 1: Draw a line segment that is longer than 5 cm and mark point A on the line.

Step 2: With centre A and a radius of 5 cm, draw an arc to cut the base line at B.

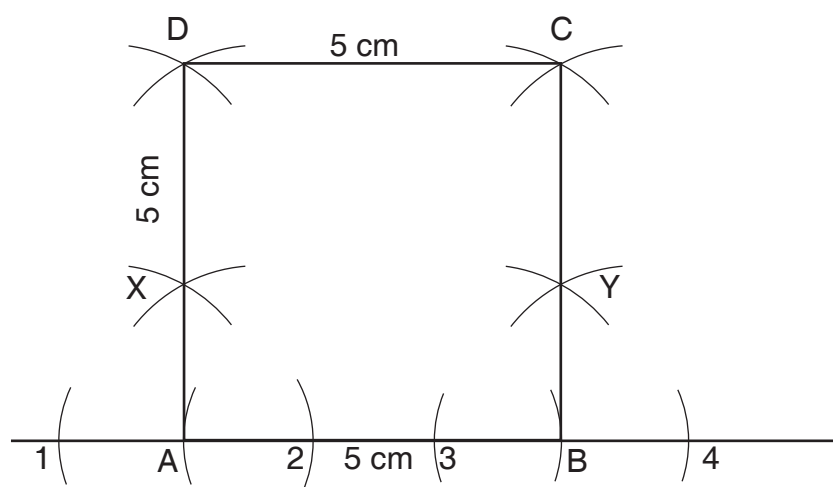
Step 3: With centre A and a convenient radius, draw arcs 1 and 2 on AB.

Step 4: Repeat with centre B and the same radius, draw arcs 3 and 4 on AB.

Step 5: With centre at 1 and a convenient radius, draw arc X above A.

Step 6: With centre at 2 and the same radius, draw an arc to cut X. Draw a line that joins A and X and that exceeds 5 cm.

Step 7: With centres at 3 and 4 and same radius, draw an arc Y above B and extend it to cut X. Draw a line that joins B and Y that is longer than 5 cm.



Activity 3: Refer learners to page 192 of the Learner's Book. Guide them to follow the steps to construct a parallelogram with four sides and a given angle.

Construct parallelogram ABCD such that $AB = 5 \text{ cm}$, $AD = 6 \text{ cm}$ and $\angle BAD = 60^\circ$.

Step 1: Construct line segment AB of length 5 cm.

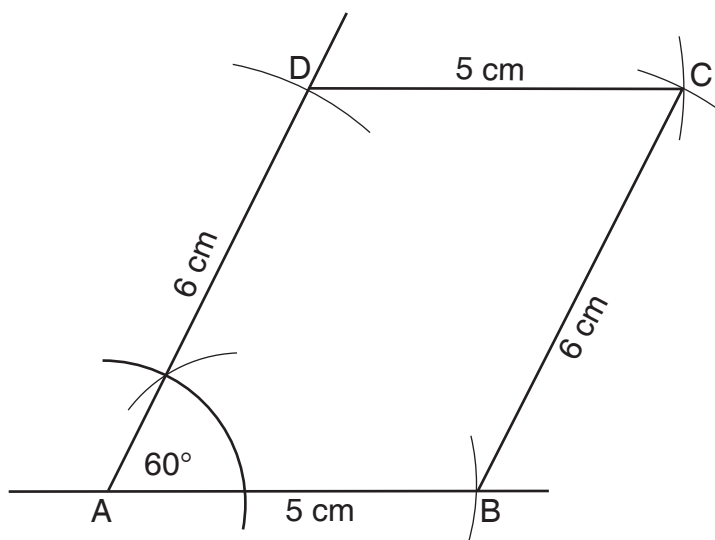
Step 2: Construct an angle of 60° at A.

Step 3: Construct line segment AD of length 6 cm on the left side of the angle.

Step 4: Draw two arcs with radii that equal the two lengths given above, A and B, and label D and C.

Step 5: With D as centre draw an arc of radius 5 cm.

Step 6: With B as centre and a radius of 6 cm, draw an arc to intersect the previous arc at C.



Activity 4: Have learners work in pairs. Demonstrate how to construct a parallelogram on the board. As you go through the steps, let learners follow the steps and construct a parallelogram.

Activity 5: Go through the worked examples on pages 193 to 196 of the Learner's Book with learners. Let them follow the steps and construct the shapes.

Review exercise

Put learners in mixed ability groups and let them do this exercise.

Construct a parallelogram ABCD with side AB = 6 cm, AD = 7 cm and $\angle BAD = 75^\circ$.

Assessment tasks ----- LB pages 196–197

Refer learners to pages 196 to 197 of the Learner's Book for the questions.

Suggested homework

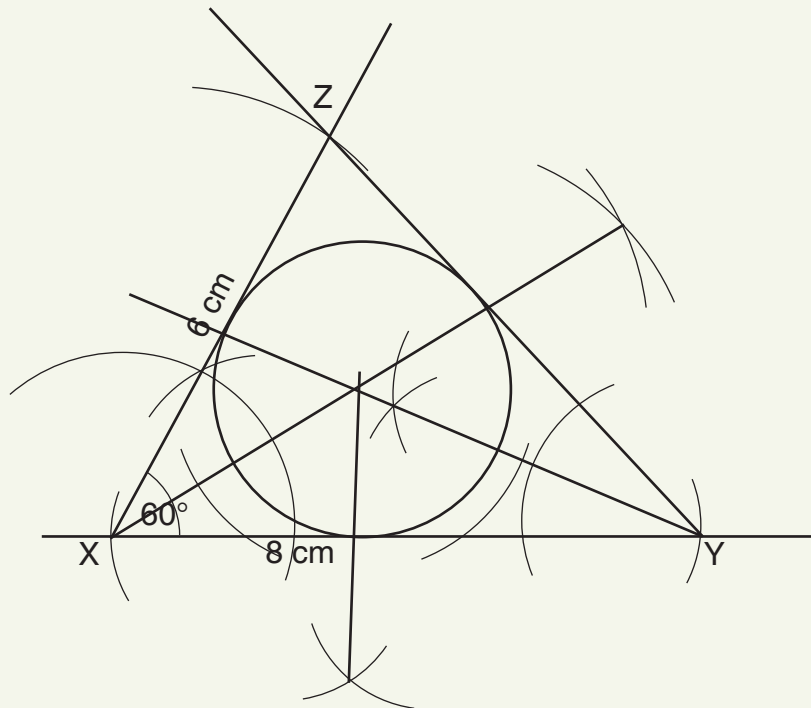
1. Construct a square PQRS with a diagonal of 6 cm.
2. Construct a rectangle ABCD with length 4.5 cm and a diagonal AC = 5.4 cm.
3. Using a ruler and a compass only, construct a parallelogram ABCD with lengths AB = 7 cm, AD = 5 cm and BC = 9 cm and angles $\angle BAD = 30^\circ$ and $\angle ADC = 120^\circ$.
 - a. Find the locus l_1 of the points equidistant from BC and CD.
 - b. Find the locus l_2 , from B perpendicular to l_1 .
 - c. Locate E_1 the point of intersection of l_1 and l_2 .
 - d. Measure the length of line DE.

Answers to Assessment tasks

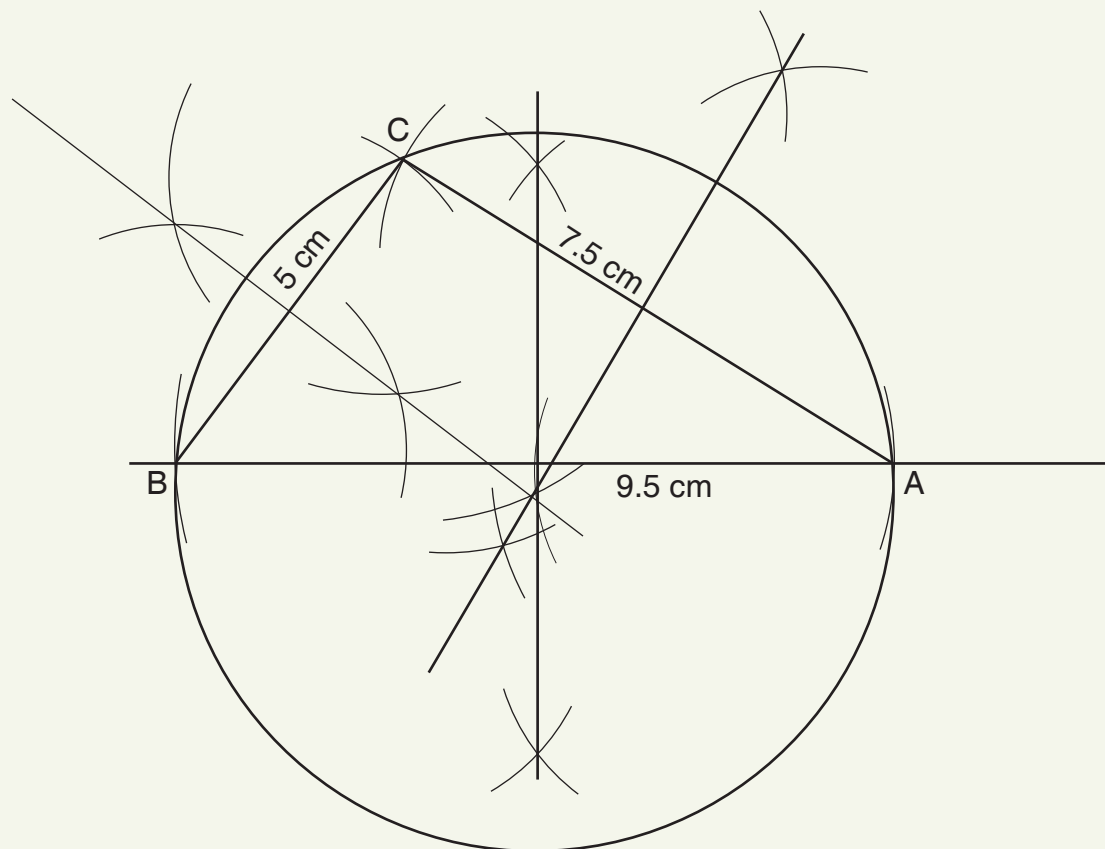
Main idea 1

(LB page 189)

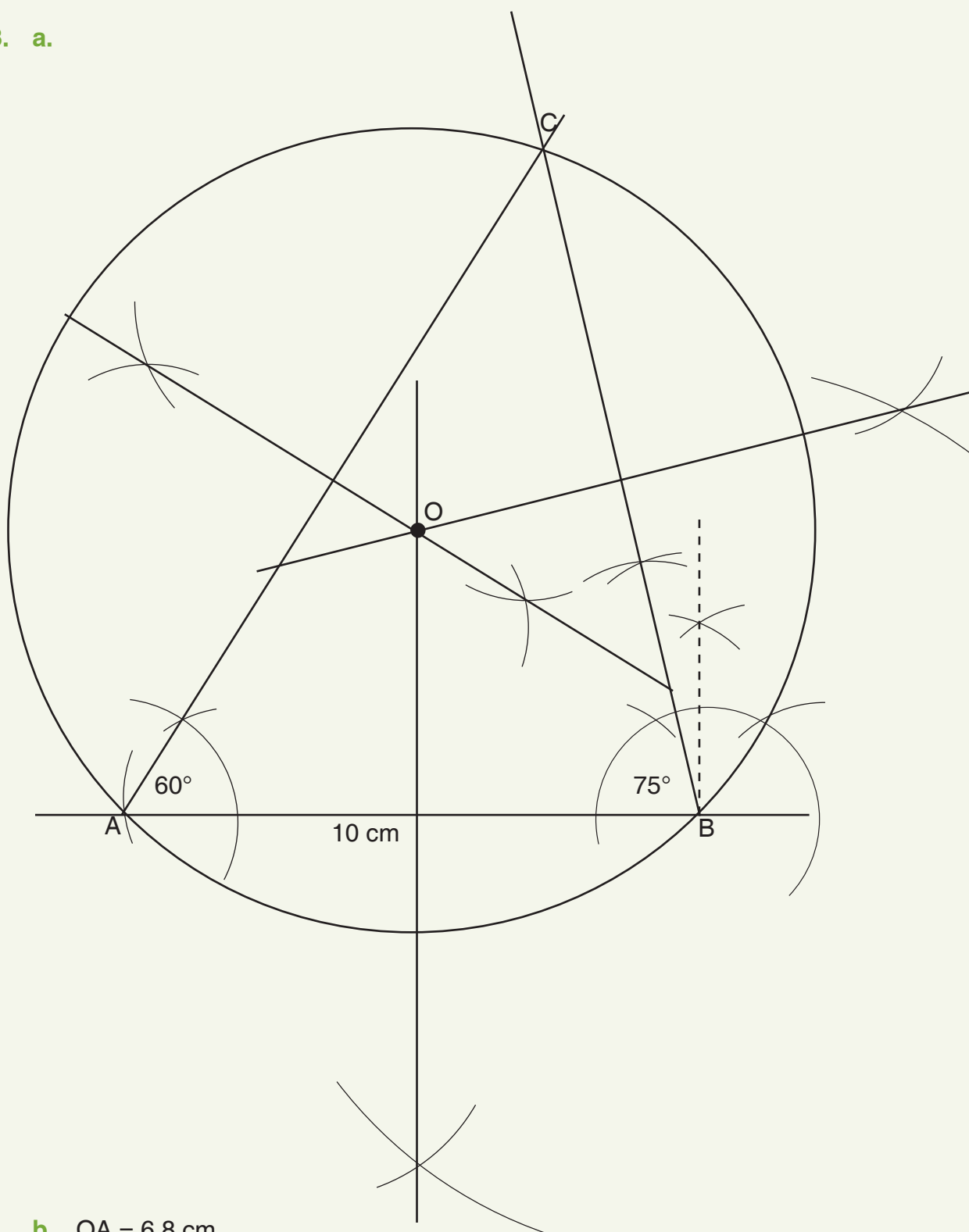
1.



2.



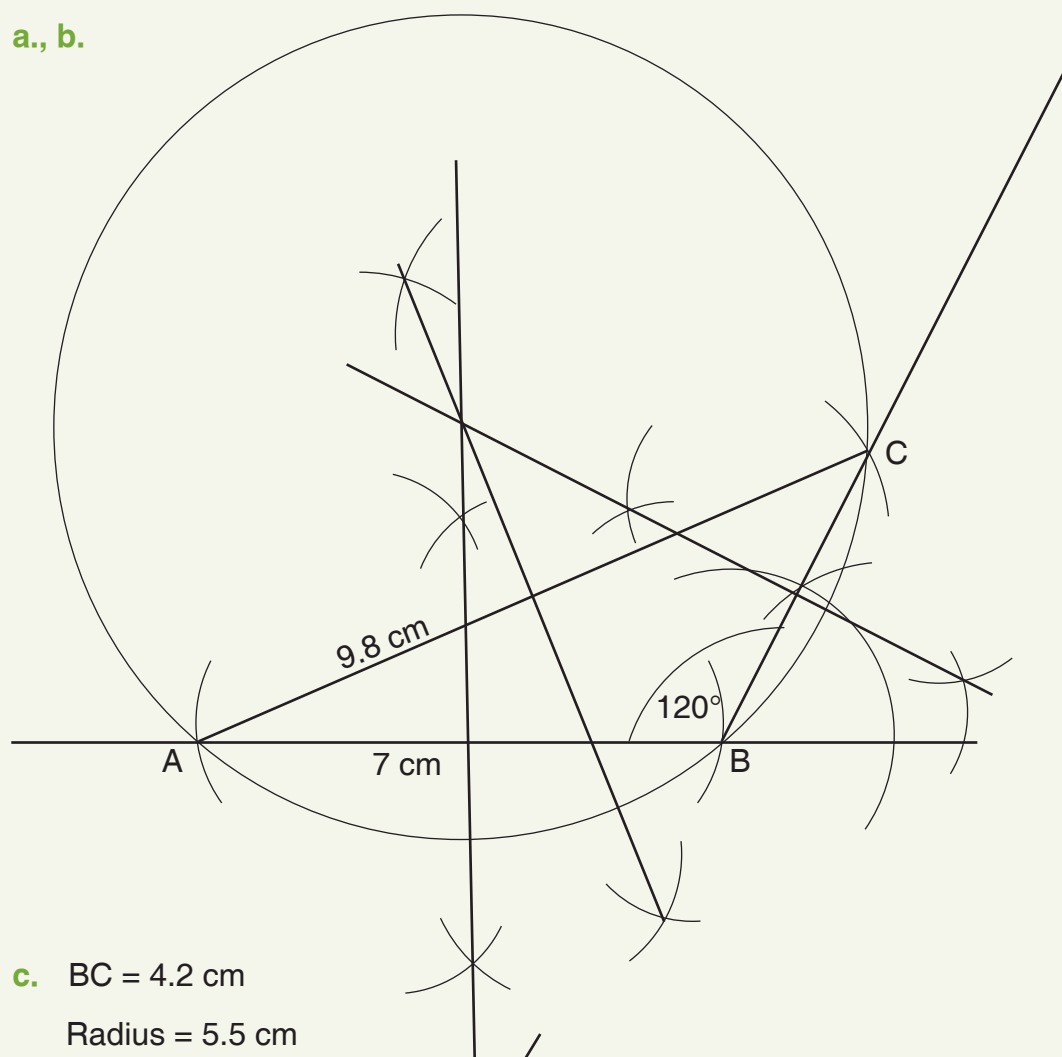
3. a.



b. $OA = 6.8\text{ cm}$

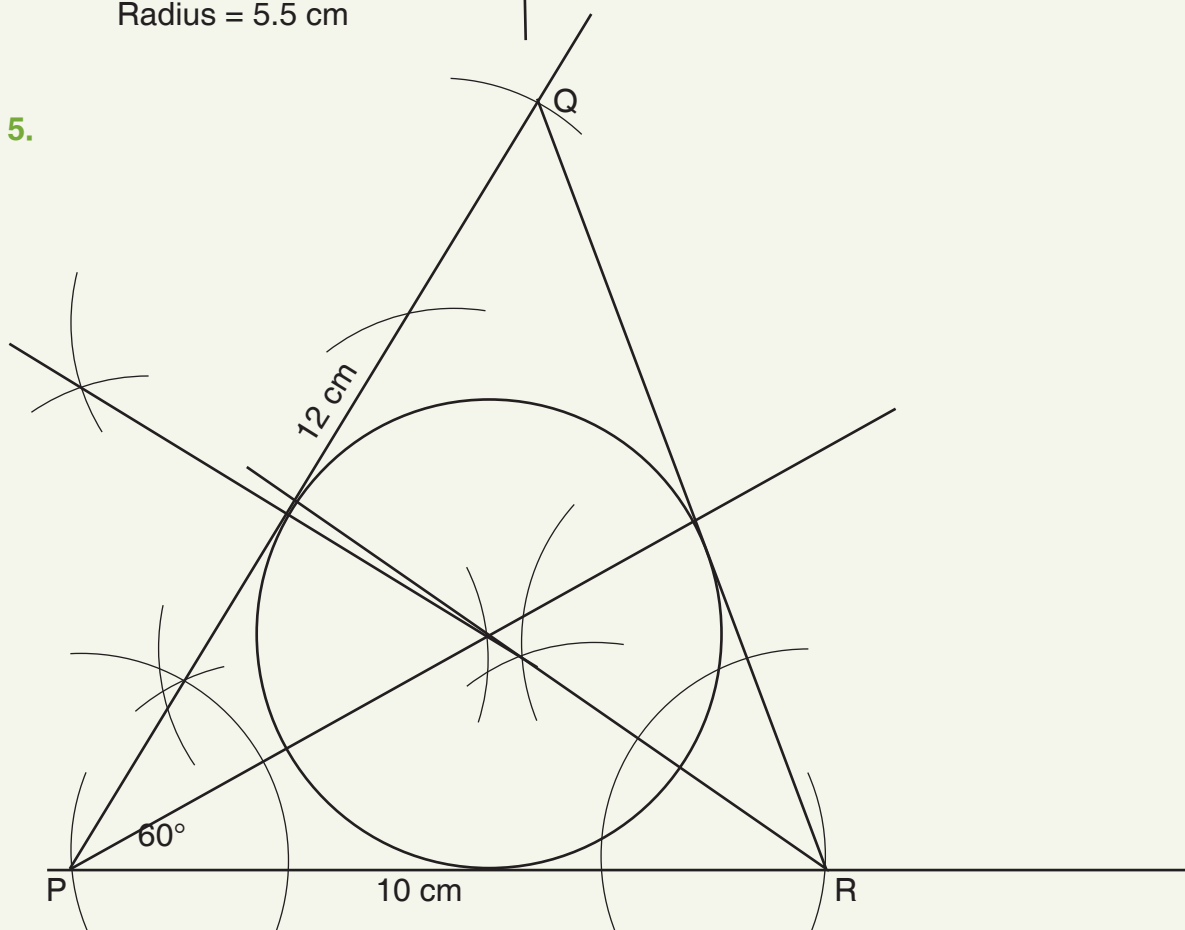
$\angle ACB = 45^\circ$

4. a., b.



c. $BC = 4.2 \text{ cm}$
Radius = 5.5 cm

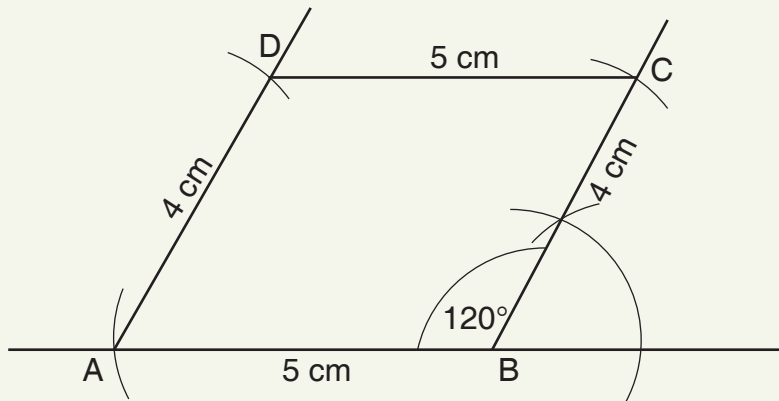
5.



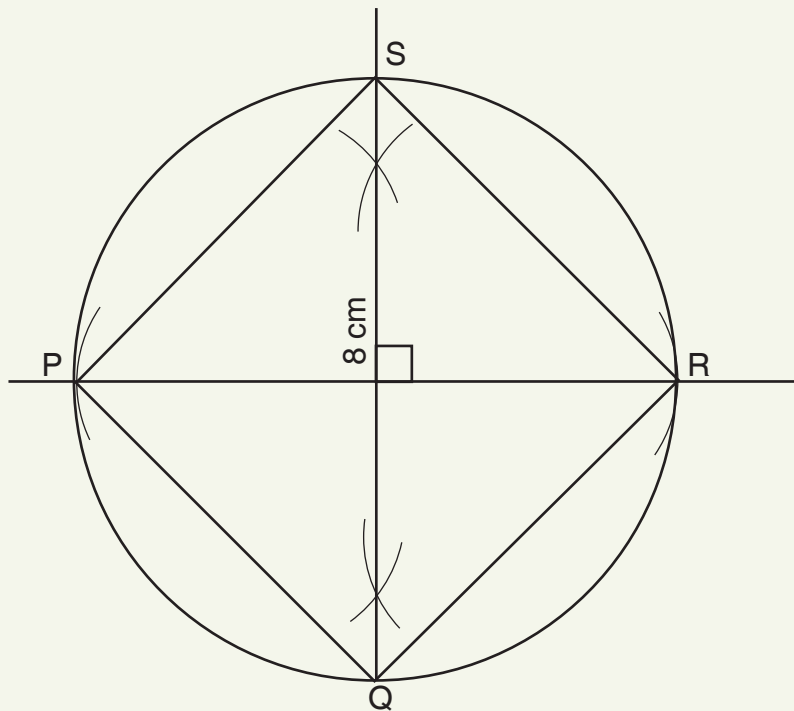
Main idea 2

(LB pages 196–197)

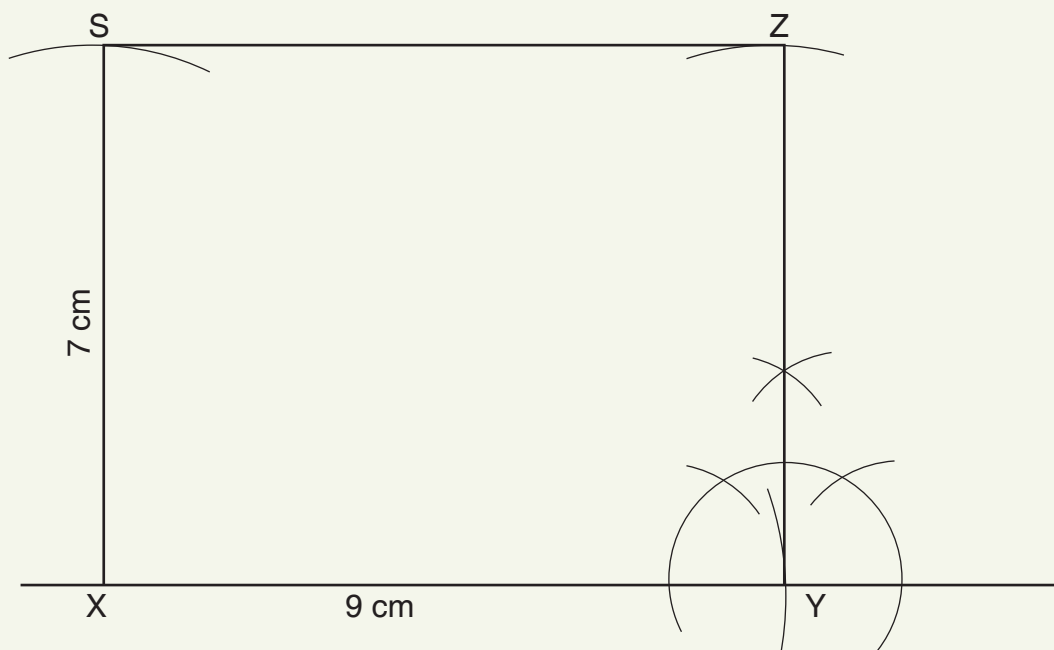
1.



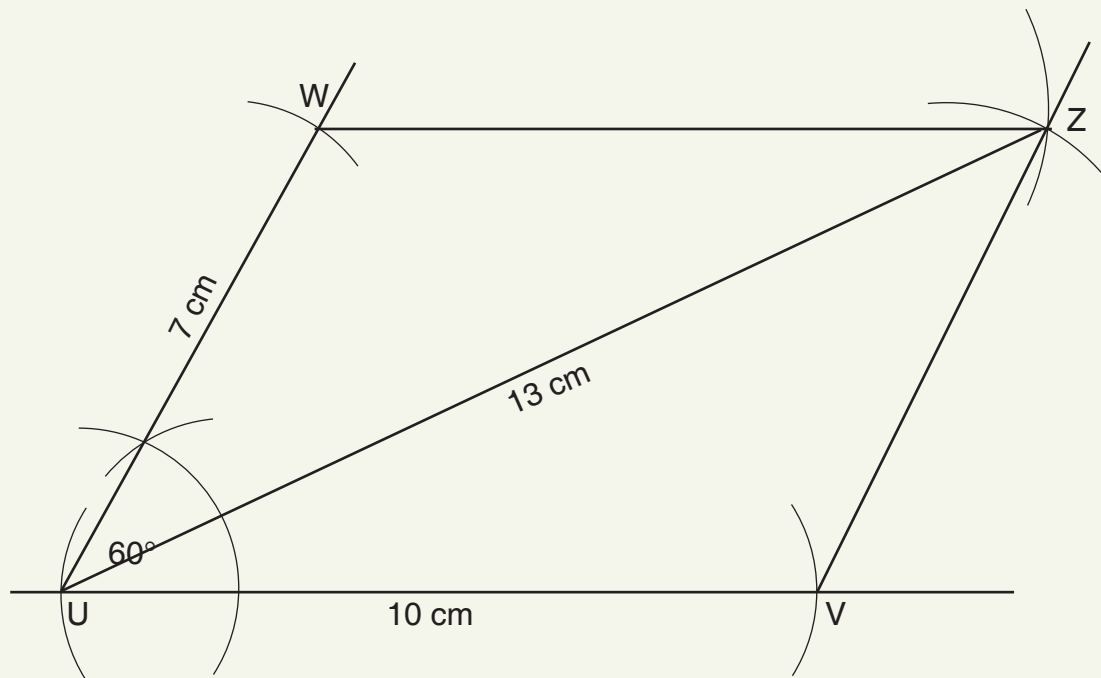
2.



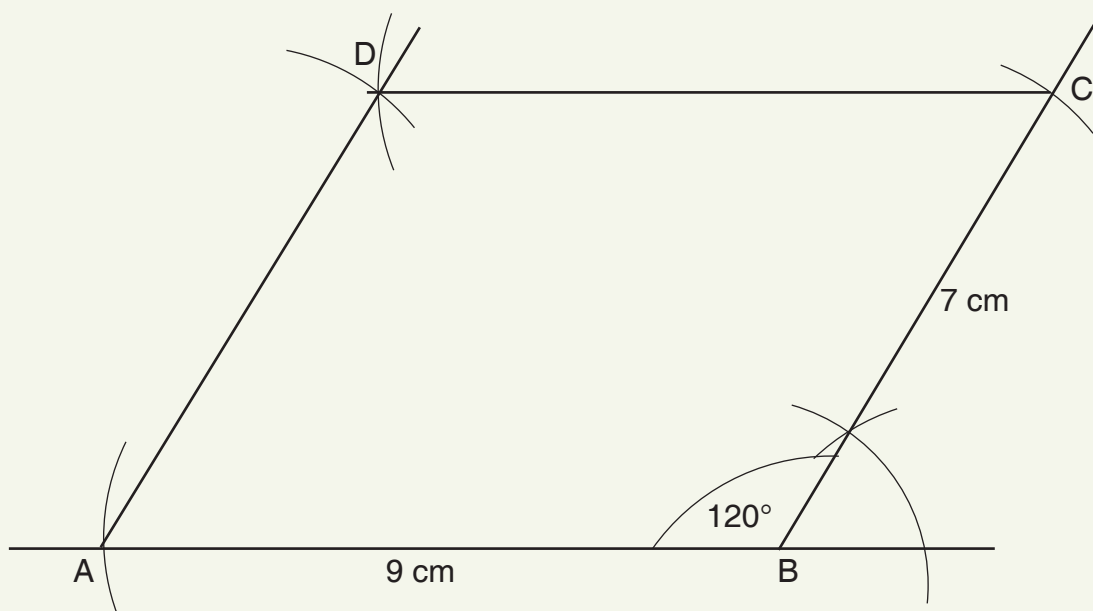
3.



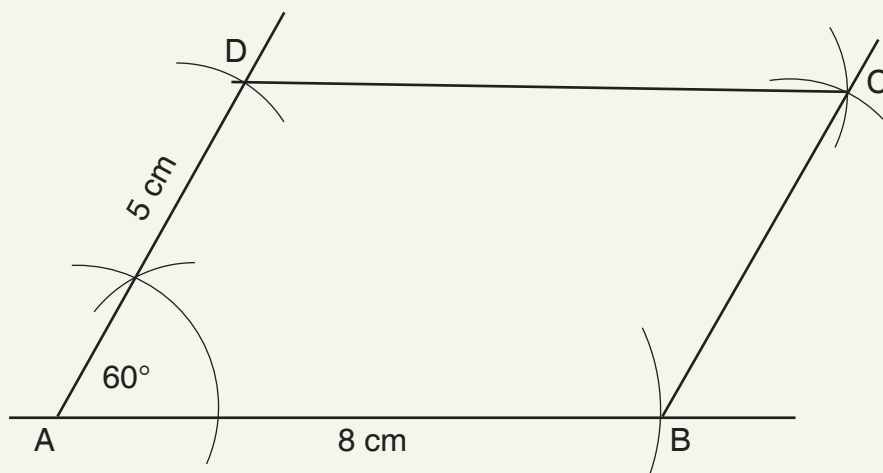
4.



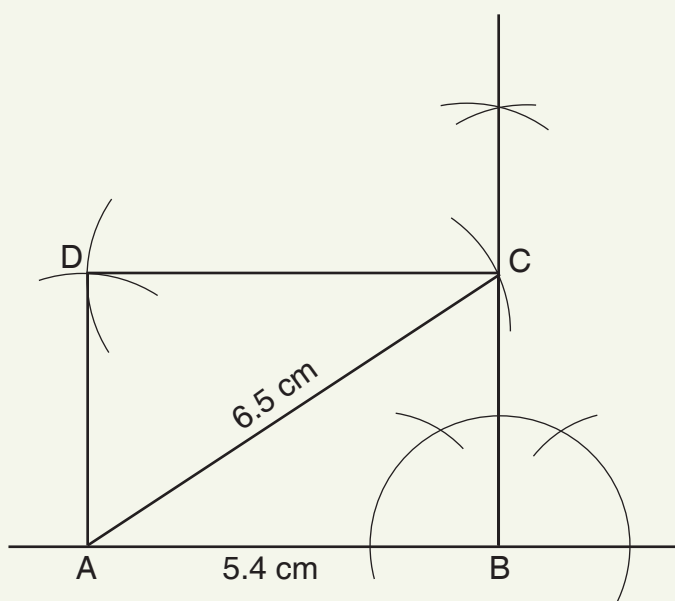
5.



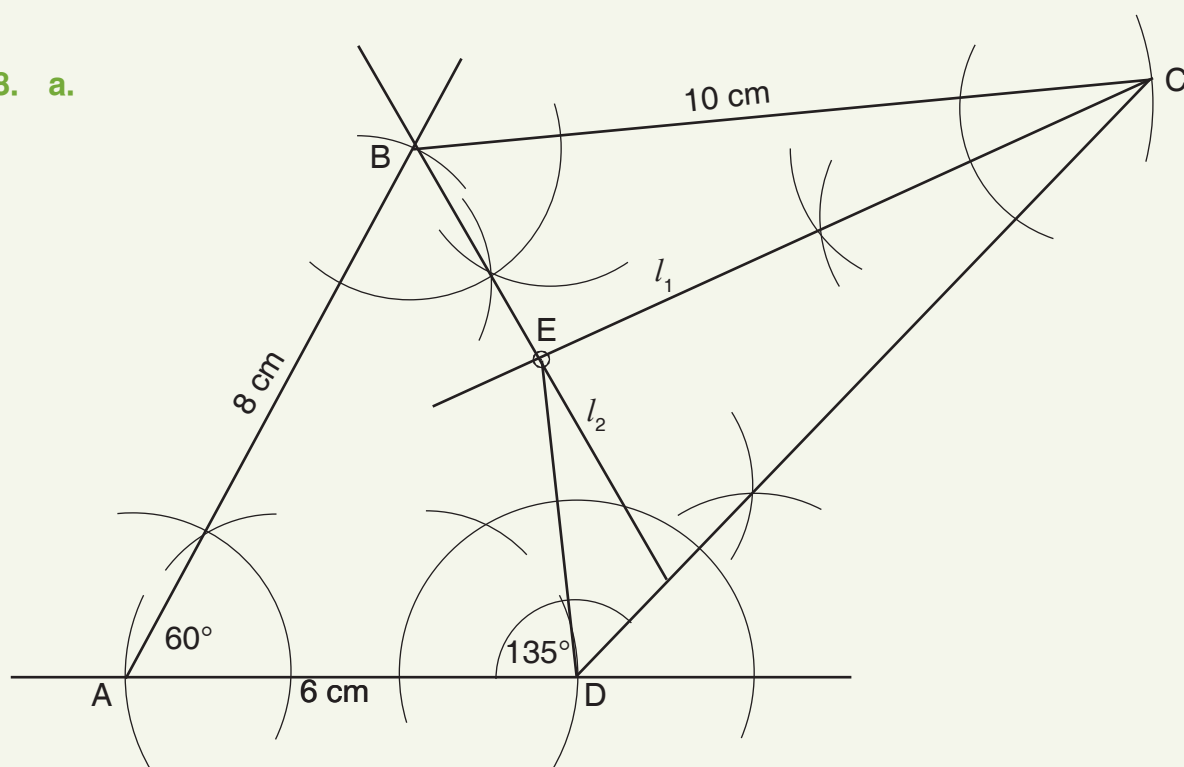
6.



7.

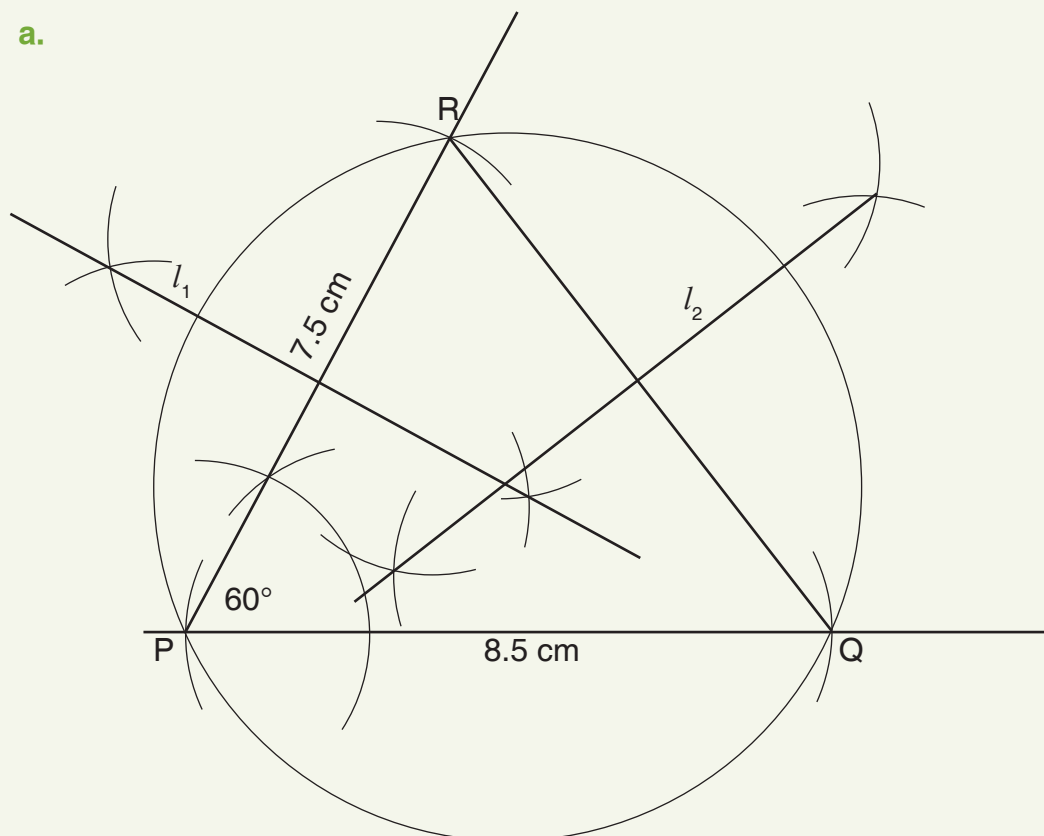


8. a.



b. ii. $DE = 4.2 \text{ cm}$

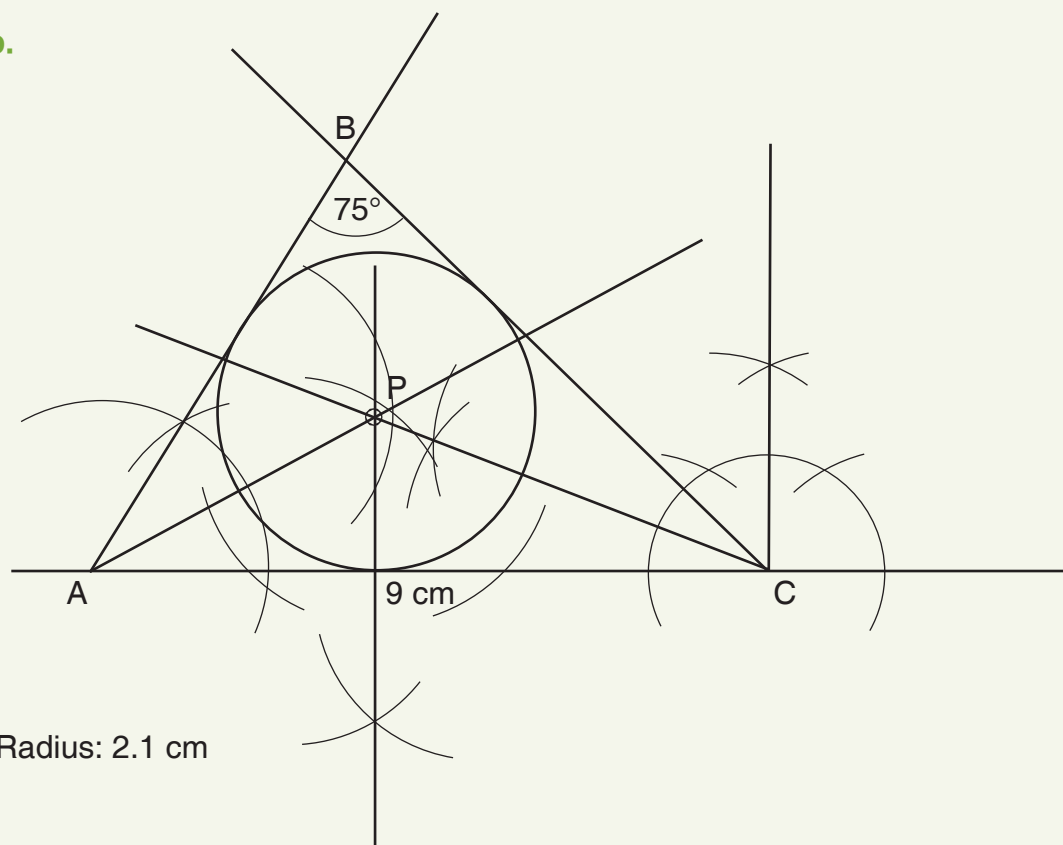
9. a.



b. ii. Radius = 4.5 cm

iii. QR = 8 cm

10. a, b.

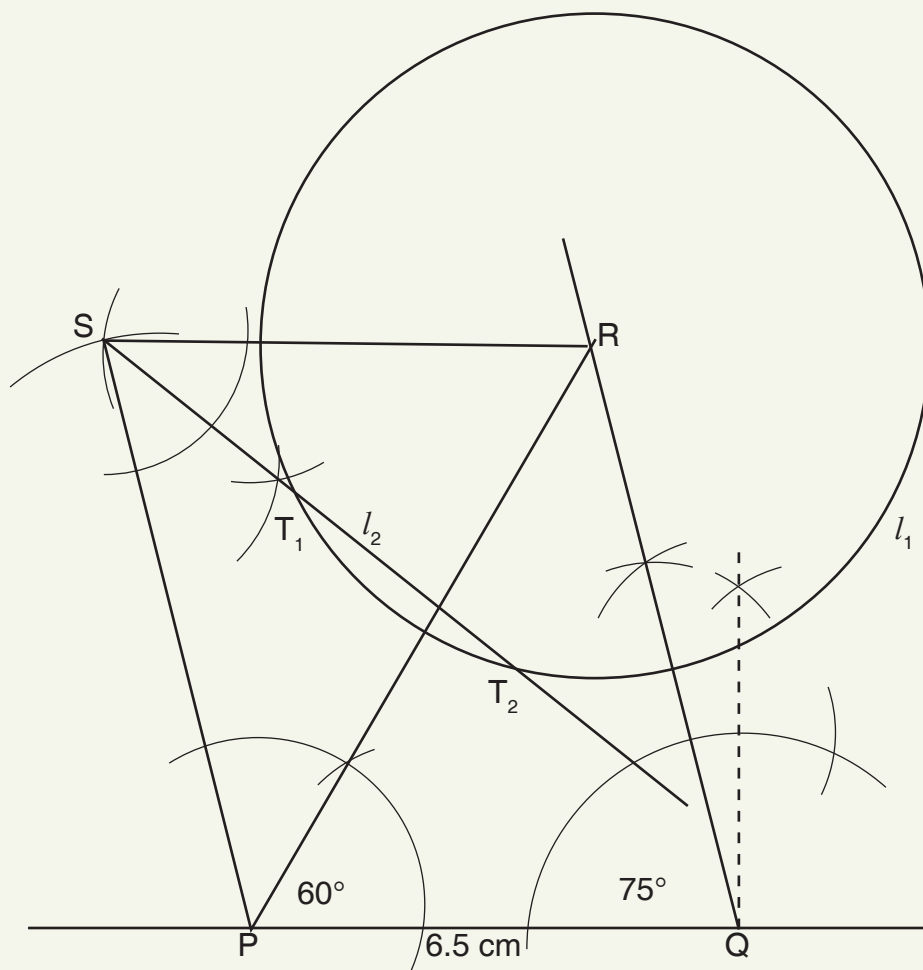


c. Radius: 2.1 cm

(LB pages 198–199)

1. 12 slides
2. a. 15 slides
3. a–c.

b. $1,080^\circ$



d. $T_1T_2 = 3.5 \text{ cm}$

4. $CE = 15 \text{ cm}$
5. Check learners constructions.
6. Check learners answers
7. $x = 33^\circ$
8. $AB = DE$; $BC = EF$; $AC = DF$ and $\angle A = \angle D$; $\angle B = \angle E$; $\angle C = \angle F$
9. a. $\triangle PQR$ is similar to $\triangle ABC$; $AC = 10$; $BC = 8$
- b. $\triangle DEF$ is similar to $\triangle PQR$; $DF = 15$; $DE = 11.25$

Sub-strand 2: Measurement**Module 1****Surface area of prisms****Content standard**

B.9.3.2.1 Derive the formulae for determining the surface area of prisms (i.e. cuboid and triangular prism) and use them to solve problems.

Indicator

B9.3.2.1.1 Identify cuboids and triangular prisms; draw their nets to construct the 3D shapes and use them to determine the surface area.

B9.3.2.1.2 Use the net of a cuboid to determine its surface area.

B9.3.2.1.3 Use the net of a triangular prism to determine its surface area.

Learning expectation: In this module, learners will learn how to:

- Identify cuboids and triangular prisms.
- Draw nets of cuboids and triangular prisms to construct the 3D shapes.
- Determine the surface area of cuboids and prisms.

Essential for learning: Learners can

- identify the various plane shapes
- determine the area of plane shapes
- identify the nets of common 2D shapes.

Resources: Pencils, notebooks, a straight rule, geodot/graph sheet, manilla card, cuboids and prisms made from paper cards

Keywords: cuboid, prism, net, surface area

Competencies: Critical thinking and problem solving, creativity and innovation, digital literacy.

Starter: Refer learner's to page 200 of the Learner's Book. Allow learners to work in pairs and share their ideas.

Main idea 1

Identifying cuboids and triangular prisms **LB pages 201–203**

Activity 1: Put learners into convenient groups.

Give each group worksheets with pictures of prisms and cuboids and ask them to discuss them.

Ask groups to define prisms and cuboids and refer to their properties (thus, faces, edges and vertices).

Visit groups to offer assistance where necessary.

Activity 2: Call out groups to present their work to the class.

Give the class the opportunity to contribute to the presentations.

Wrap up on the presentations by giving all information that is missing from learners' presentations and address all misconceptions.

Activity 3: Engage learners in a discussion on a few real-life examples of objects that have the shape of prisms and cuboids. Examples: boxes, match box, cheese, books, cupboard, and so on.

Activity 4: Refer learners to Main idea 1 on pages 201 to 203 of the Learner's Book.

Reflection

Ask learners to take part in a discussion about what they have learnt today (identifying cuboids and triangular prisms). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated lessons

Remedial activity

Learners identify items that have the shape of a prism or a cuboid. Ask learners to draw and label them.

Challenging activity

Learners identify items that have the shape of prisms and cuboids. They also identify the properties of prisms and cuboids.

Assessment tasks ----- **LB pages 203–204**

Refer learners to pages 203 and 204 of the Learner's Book for the questions.

Main idea 2

Nets of cuboids and triangular prisms

LB pages 204–205

Activity 1: Ask learners to work in the same groups they worked in earlier.

Present groups with manila cards and ask learners to sketch and cut out the nets of a given prism and cuboid.

Visit groups to offer assistance where needed.

Activity 2: Ask groups to present their work to the class.

Ask learners to compare the different nets for the same prism or cuboid.

Wrap up on the presentations by giving all information that is missing from learners' presentations and address all misconceptions.

Activity 3: Ask learners to open up the nets of an object that has the shape of a prism or cuboid and compare it to what they have done.

Activity 4: Refer learners to Main idea 2 on pages 204 and 205 of the Learner's Book.

Reflection

Ask learners to take part in a discussion about what they have learnt for the day (nets of cuboids and triangular prisms). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated lessons

Remedial activity

Draw the net of a cuboid or a prism.

Challenging activity

Draw three different nets of a given prism or cuboid and describe the parts of the net.

Assessment tasks ----- LB page 205

Refer learners to page 205 of the Learner's Book for exercise.

Main idea 3

Determining the surface area of cuboids and triangular prisms

LB pages 205–206

Activity 1: Review the previous lesson about identifying cuboids and triangular prisms.

Also, review the method to use to calculate the areas of 2D shapes.

Put learners into mixed-ability groups.

Ask groups to use their knowledge of area measurement to determine the area of the different parts of the net of a prism to determine the surface area of an object.

Activity 2: Ask learners to analyse the problem they solved to derive a general formula for finding the surface area of cuboids and triangular prisms.

Give learners a few task sheets and real-life examples to solve. For example, ask them to calculate the surface areas of the top of tables, surface areas of books, surfaces of box, and so on.

Wrap up on the lesson by providing any further information and addressing all misconceptions.

Activity 3: Refer learners to Main idea 3 on pages 205 and 206 of the Learner's Book.

Reflection

Ask learners to take part in a discussion about what they have learnt for the day (determining the surface area of cuboids and triangular prisms). Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated lessons

Remedial activity

Find the total surface area of a cuboid with a length of 6 cm, breadth of 5 cm and a height of 2 cm.

Challenging activity

Give learners real-life objects such as the Mathematics textbook or a triangular prism. Let them measure and find the surface area.

Assessment tasks ----- LB pages 209–210

Refer learners to pages 209 and 210 of the Learner's Book for the questions.

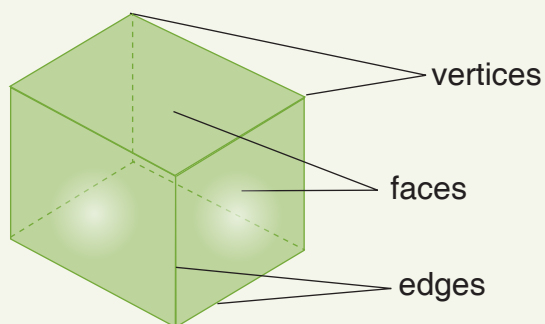
Answers to Assessment tasks

Main Idea 1

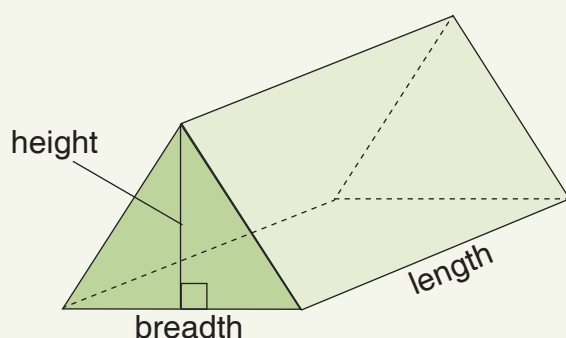
(LB page 203–204)

1. Real-life examples of cuboids:
books, match boxes, photo frames, mattresses, six-sided dice, laptops, bricks, wooden beams, blocks, tissue boxes and mobile phones
2. Real-life examples of triangular prisms:
rooftops, camping tents, doorstops, wedges and chocolate candy bars

3.



4.



A triangular prism

5. Properties of a cuboid:

- It has 6 faces, 8 vertices and 12 edges.
- All the faces are rectangular.
- It has three dimensions: length, width or breadth and height.
- All the opposite edges are parallel.
- The angles at the vertices are all 90° .

Properties of a triangular prism:

- It has 5 faces, 6 vertices and 9 edges.
- It has two bases that are in the shape of a triangles and three rectangular sides.
- It has three dimensions: length, breath and height.

6. Faces – ABCD, ABGF, EFGH, CDEH, and BCHG

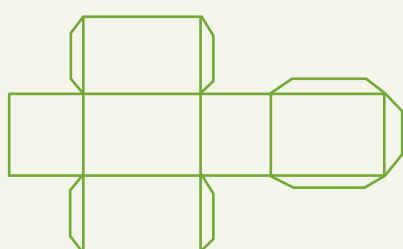
Edges – AB, BC, CD, AD, BG, FG, AF, FE, EH, GH, DE, and CH

Main idea 2

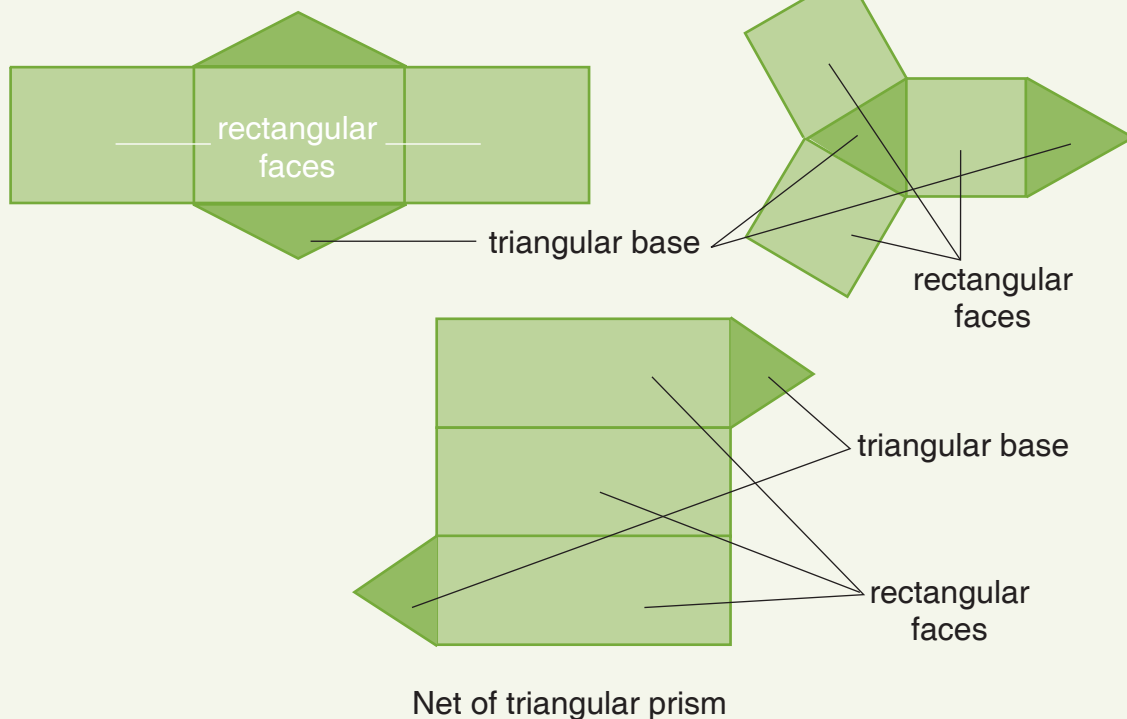
(LB page 205)

1. The net of a 3D shape is if the shape is opened out and laid flat.

2.



The net of a cuboid



4. The net of a cuboid will contain six rectangles
5. The net of a triangular prism consists of three rectangles and two triangles

Main idea 3

(LB pages 209–210)

1. 27 cm^2
2. 108 cm^2
3. 162.5 cm^2
4. Surface area = $ab + (a + b + c) \times l$ square units
5. 324 m^2
6. 433.14 square feet
7. $2,040 \text{ m}^2$
8. 98 square inches

Sub-strand 2: Measurement**Module 2****Bearings and vectors****Content standard**

B.9.3.2.1 Derive the formulae for determining the surface area of prisms (i.e. cuboid and triangular prism) and use them to solve problems.

B9.3.2.2 Solve problems involving bearings and the addition or subtraction of vectors.

Indicator

B9.3.2.1.4 Express points in the Cartesian plane as position vectors.

B9.3.2.2.1 Show an understanding of parallel vectors and perpendicular vectors.

B9.3.2.2.2 Apply the triangular and parallelogram laws of addition to resolve vectors.

Learning expectations: In this module, learners will learn how to:

- Express points on the Cartesian plane as position vectors.
- Distinguish between parallel and perpendicular vectors with solved examples.
- Resolve vectors using triangular and parallelogram laws of addition.

Essential for learning: Learners can:

- Measure given angles such as 90° , 180° and 270°
- Identify parallel and perpendicular lines.
- Identify points in a coordinate plane.

Resources: Pencils, notebooks, a straight rule, geodot/graph sheet, manilla card

Keywords: laws, vectors, parallel, parallelogram, Cartesian plane

Competencies: Communication and collaboration, Critical thinking and problem solving, creativity and innovation, digital literacy

Starter: Refer to Learner's Book pages 211 and 212. Allow learners to work in pairs and to share ideas.

Main idea 1

Position vector

LB pages 212–213

Activity 1: Review the previous lesson on bearings. Lead a whole class discussion on the meaning of vectors and their application to real-life. Discuss position vectors and solve some examples that include these vectors.

Activity 2: Put learners into convenient groups. Give each group worksheets with questions that ask them to find position vectors. Engage learners with questions and real-life examples on position vectors to solve.

Activity 3: Refer learners to main idea 1 on pages 212 and 213 of the Learner's Book and go through the text with them.

Wrap up on the lesson by providing further information as necessary and addressing all misconceptions.

Reflection

Engage learners to talk about what they have learnt today about position vectors. Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings. Refer to the worked examples on pages 213 to 215 in the Learner's Book

Review exercise

Differentiated lessons

Remedial activity

Solve problems that involve position vectors.

Challenging activity

Create and solve real-life problems on determining position vectors.

Assessment tasks ----- LB pages 215–216

Refer learners to pages 215 and 216 of the Learner's Book for the questions.

Main idea 2

Parallel and perpendicular vectors

LB pages 216–217

Activity 1: Review position vectors with the class. Lead a whole class discussion about the special relationship that forms between two or more vectors when they point in the same direction or in opposite directions as parallel vectors.

Discuss the dot product and cross product of parallel vectors and ask learners to solve a few problems that include these products.

Activity 2: Give learners task sheets about dot and cross products vectors to solve. Put learners into convenient groups and ask them to discuss the properties of parallel vectors.

Activity 3: Refer learners to Main idea 2 on pages 216 and 217 of the Learner's Book and go through the text with them.

Wrap up on the lesson by providing any further information and addressing all misconceptions.

Reflection

Engage learners to talk about what they have learnt today about parallel and perpendicular vectors. Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated lessons

Remedial activity

Solve problems that include parallel and perpendicular vectors.

Challenging activity

Create and solve problems that include parallel and perpendicular vectors.

Assessment tasks ----- LB page 220

Refer learners to page 220 of the Learner's Book for exercise.

Main idea 3

Triangular and parallelogram laws for the addition of vectors

LB pages 221–222

Activity 1: Review parallel and perpendicular vectors. (Refer to pages 216 to 220 of the Learner's Book for notes and worked examples.)

Activity 2: Lead a whole class discussion about the triangle law of vector addition and the parallelogram law of vector addition.

Activity 3: Ask learners to use the formulae for the parallelogram and triangle laws of vector addition to solve a few problems. (Refer to page 222 of the Learner's Book for notes and examples.)

Activity 4: Put learners in convenient groups and give them worksheets with problems that include vector addition to discuss and solve.

Activity 5: Refer learners to Main idea 3 on pages 221 and 222 of the Learner's Book and go through the text with them.

Wrap up on the lesson by providing further information as necessary and addressing all misconceptions.

Reflection

Engage learners to talk about what they have learnt today about triangular and parallelogram laws and the addition of vectors. Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated lessons

Remedial activity

Solve problems on parallel and perpendicular vectors.

Challenging activity

Create and solve problems on parallel and perpendicular vectors.

Assessment tasks ----- LB page 226

Refer learners to page 226 of the Learner's Book for the questions.

Answers to Assessment tasks

Main idea 1

(LB pages 215–216)

1. $\vec{QP} = \left(\frac{-9}{-5}\right)$
2. $\vec{PQ} = \left(\frac{9}{5}\right)$
3. $\vec{AB} = \left(\frac{-3}{10}\right)$
4. $\vec{OQ} = \left(\frac{-3}{7}\right)$
5. $V = \vec{QP} = \left(\frac{-7}{-5}\right)$

Main idea 2

(LB page 220)

1. **a.** Perpendicular **b.** Parallel **c.** Neither
2. **a.** $k = 5$ **b.** $k = \pm 2\sqrt{3}$
3. **a.** $k = -\frac{3}{2}$ **b.** $k = \pm 2$

Main idea 3

(LB page 226)

1. **a.** $\vec{PR} = \left(\frac{-1}{7}\right)$ **b.** $\vec{PR} = \left(\frac{3}{-9}\right)$ **c.** $\vec{PR} = \left(\frac{-3}{-1}\right)$ **d.** $\vec{PR} = \left(\frac{10}{4}\right)$
2. The explorer's displacement is 16.2 m at 8.5° NW.
3. The jogger's displacement is 15 blocks at 36.9° SE.

- [illegible]

Sub-strand 3: Position and transformation

Module 1

Enlargement and similarities

Content standard

B9.3.3.1 Demonstrate understanding of how to perform an enlargement on a geometrical shape given a scale factor and describe the properties of the image under the transformation (i.e. congruence, similarity, etc.).

Indicator

B9.3.3.1.1 Know examples of situations in everyday life that depict enlargement situations in everyday life.

B9.3.3.1.2 Understand enlargement and identify real-life situations involving enlargement.

B9.3.3.1.3 Investigate the concept of congruent and similar shapes.

Learning expectations: In this module, learners will learn how to:

- Identify everyday life examples of enlargement.
- Explain the concept of enlargement with relevant examples.
- Determine congruent and similar shapes.

Essential for learning: Learners can:

- Identify common 2D shapes and explain their properties.
- Compare objects and give reasons why one is larger or smaller than the other.

Resources: Pencils, notebooks, a straight rule

Keywords: Enlargement, similar shapes, congruent shapes

Competencies: Critical thinking and problem solving, creativity and innovation, communication and collaboration, personal development and leadership, digital literacy

Starter: Refer to Learner's Book page 228. Allow learners to share ideas.

Main idea 1

Enlargement and similarity

LB pages 229–231

Activity 1: Review learners' understanding of transformations. Put learners into convenient groups. Ask them to brainstorm on what they understand by the concept *enlargement* and support their ideas with real-life examples.

Activity 2: Refer learners to Main idea 1 on pages 229 to 231 of the Learner's Book and go through the text with them.

Activity 3: Transition to a whole class activity, and lead a discussion on the concept of scale factor and centre of enlargement.

Activity 4: Transition learners back to groups and refer them to worked examples on pages 231 to 239 of the Learner's Book for practical examples of enlargement and similarity and ask them to discuss and give real-life situations where these transformations can be used.

Groups may use drawings to support their examples where necessary.

Activity 5: Ask groups to make presentations to the class.

Wrap up on the lesson by summarising the main ideas and addressing all misconceptions.

Reflection

Engage learners to talk about what they have learnt about rotation. Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings. Refer to the worked examples on pages 231 to 239 in the Learner's Book

Review exercise

Differentiated lessons

Remedial activity

Solve problems that involve enlargement and similarities.

Challenging activity

Solve problems that involve enlargement and similarities and create their own real-life problems to solve.

Assessment tasks ----- LB pages 239–242

Refer learners to pages 239 to 242 of the Learner's Book for the questions.

Main idea 2

Determining congruent and similar shapes LB pages 242–246

Activity 1: Review learners' knowledge of congruence and similarities, which they learnt about in Basic 7. Put learners into convenient mixed ability groupings. Ask groups to discuss the term *congruence*. Present their findings to the class.

Activity 2: Ask learners to discuss the term, *similarity* and give real-life examples. Ask learners to discuss the relationship between the concepts, *congruence* and *similarity*.

Activity 3: Refer learners to Main idea 2 on pages 242 to 246 and to read the text from the Learner's Book to support their understanding of congruence and similarity. Ask groups to discuss the conditions for congruence in triangles and give them the opportunity to make presentations to the class. Learners may support their presentations with diagrams.

Activity 4: Go through the worked examples on pages 246 to 249 of the Learner's Book with learners to reinforce their understanding of congruence and similarity.

Wrap up on the lesson by summarising ideas from the lesson and addressing all misconceptions.

Review exercise

Differentiated lessons

Remedial activity

Identify congruent shapes and solve problems involving congruence.

Challenging activity

Identify congruent shapes in real-life and create congruent problems and solve the problems.

Assessment tasks ----- LB pages 249–252

Refer learners to pages 249 to 252 of the learner's book for the questions.

Answers to Assessment tasks

Main idea 1

(LB pages 239–241)

1. $k = \frac{S'T'}{ST} = \frac{T'U'}{TU} = \frac{U'V'}{UV} = \frac{V'S'}{VS}$

2. $k = 2$

3. Centre of enlargement = $(-1, 7)$

4. Check learner's drawing

5. $A'(9, 9)$

$B'(15, 9)$

$C'(15, 3)$

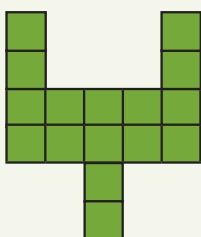
6. $A'(4, 4)$

$B'(12, -8)$

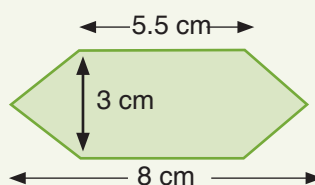
$C'(32, 0)$

$D'(0, 0)$

7. a.



b.



Not drawn to scale

8. 15 m

9. Height = 5 cm
 10. $k = \frac{1}{2}$
 11. $x = 9$ cm ; $y = 3.2$ cm

Main idea 2

(LB pages 249–252)

- | | | | |
|---|--|--|------------------|
| 1. a. Not congruent | b. Congruent | c. Congruent | d. Not congruent |
| 2. a. 3.1 cm | b. 119° | c. 105° | d. 5.7 m |
| 3. a. $\triangle ABC \cong \triangle DEF$ | b. $\triangle UVW \cong \triangle XYZ$ | c. $\triangle PQR \cong \triangle STR$ | |
| d. $\triangle KLM \cong \triangle FGE$ | e. $\triangle DEF \cong \triangle XYZ$ | f. $\triangle TUZ \cong \triangle WXY$ | |
| g. $\triangle JKL \cong \triangle NML$ | h. $\triangle CDE \cong \triangle FED$ | | |
| 4. a. $\triangle PQR \sim \triangle CBA$ | b. $\triangle XYZ \sim \triangle EFQ$ | c. $\triangle NPQ \sim \triangle KLM$ | |
| d. $\triangle WQP \sim \triangle LMS$ | e. $\triangle EFG \sim \triangle RQP$ | f. $\triangle ABC \sim \triangle RQP$ | |
| g. $\triangle MNP \sim \triangle XYZ$ | h. $\triangle TVU \sim \triangle QRP$ | | |
| 5. a. $x = 5; y = 36$ | b. $x = 4.2; y = 19.8$ | c. $x = 36.92; y = 11.2$ | |
| d. $a = 28, b = 3.57$ | e. $a = 7, b = 18$ | f. $a = 51, b = 75$ | |
| g. $x = 30, y = 21$ | h. $a = 27, b = 6$ | | |

Answers to Revision

10

(LB page 253 - 254)

1. $\triangle ABC \cong \triangle GHI$; AAS $\triangle ABC \cong \triangle GFE$; SSS $\triangle ABC \cong \triangle JKL$; SAS
2. a. $\triangle ABC$, $AB = DE$, $BC = EF$ and $CA = FD$
 $\therefore \triangle ABC \cong \triangle DEF$ (SSS)
- b. $AB = DB$, $AC = DC$, BC is common to both $\triangle ABC$ and $\triangle DCB$
 $\therefore \triangle ACB \cong \triangle DCB$ (SSS)
- c. $BC = DF$, $AC = EF$, $\angle ACB = \angle EFD$
 $\therefore \triangle ACB \cong \triangle EFD$ (SAS)
- d. $\angle ABE = \angle CBE = 90^\circ$, $AE = CE$ = hypotenuse, $AB = BC$
 $\therefore \triangle ABE \cong \triangle CBE$ (RHS)
3. $A'(3, 0)$, $B'(0, 9)$ and $C'(9, 9)$
4. $k = \frac{25}{18}$ or $k = 1.39$; the dilation is an enlargement.
5. a. $x = 5$ b. $x = 3$ c. $x = 2$ d. $x = 10$
 e. $x = 7$ f. $x = 36$ g. $x = 110$ h. $x = 100$

Sub-strand 1: Data

Module 1

Data collection, organisation and interpretation

Content standard

B9.3.4.1.1 Select, justify, and use appropriate methods of collecting data (grouped/ungrouped), use the data to construct and interpret frequency tables and histogram and use it to determine the mode and to solve and/or pose problems.

Indicator

B9.4.1.1.1 Select and justify a method to collect data (quantitative and qualitative) to answer a given question.

B9.4.1.1.2 Organise data (grouped/ungrouped) and present it in frequency tables, histograms, line graphs, circle graphs, bar graphs, and picture graphs and analyse it to solve and/or pose problems.

B9.4.1.1.3 Use a histogram to determine the mode of a given data to solve and/or pose real-life cases.

B9.4.1.2.1 Select a method for collecting data (quantitative and qualitative), taking into consideration how bias (use of language, ethics, cost, time and timing, privacy or cultural sensitivity) may influence data.

Learning expectations: In this module, learners will learn how to:

- Select a data collection method that is suitable for collecting certain data.
- Justify why a particular data collection method should be used to collect a certain data.
- Sort data into grouped and ungrouped data, numerical data, categorical data, and so on.
- Represent data on frequency tables, line graphs, pie charts, bar charts, histogram, and so on.
- Interpret data to solve and pose problems.

Essential for learning: Learners can:

- Identify and discuss some methods for collecting data.
- Talk about data presentation tools.
- Discuss some activities for which each data collection method can be used to collect data on.

Resources: Pencils, notebooks, graph books

Keywords: survey, questionnaire, respondent, data, quantitative data, qualitative data, grouped data, bias

Competencies: Critical thinking and problem solving, creativity and innovation, communication and collaboration, cultural identity and global citizenship, personal development and leadership, digital literacy

Starter: Refer to Learner's Book page 256 and ask learners to discuss the pie chart and use the information to draw a bar chart. Allow learners to work in pairs and share their understanding.

Main idea 1

Data collecting methods

LB pages 257–259

Activity 1: In a whole class discussion, assess learners' knowledge of data collection, analysis and presentation from Basic 7 and Basic 8.

Activity 2: Transition to mixed-group activities by putting learners in convenient groups. Ask groups to discuss and list at least four examples of data collection methods.

Activity 3: Ask groups to take part in a class discussion. Where necessary, ask them to justify their answers.

Activity 4: Assign each group a method to use for data collection from Learner's Book. Refer them to main idea 1 on pages 257 to 259 and tell them to research the method and provide information about the kind of data they can use the method to collect.

Activity 5: Ask groups to take turns to present their work for a class discussion. Where required, ask them to justify their responses.

Activity 6: Go through the worked examples on page 260 with learners.

Activity 7: Ask learners to work in groups of two or four and ask each group to create a real-life problem or situation and decide with justification the kind of data collection method that will be appropriate to collect data in that situation. Let learners present their work to the class.

Wrap up on each presentation by offering the class the opportunity to ask questions or make suggestions that add the necessary information that learners missed.

Review exercise

Differentiated lessons

Remedial activity

Identify and explain at least two data collection methods and the type of data we can use each method to collect.

Challenging activity

Identify and explain at least four data collection methods and the type of data we can use each method to collect.

Assessment tasks ----- LB page 261 - 264

Refer learners to pages 261 to 264 of the Learner's Book for the questions.

Main idea 2

Grouped and ungrouped data

LB page 264

Activity 1: Review learners' knowledge of data collection methods.

Activity 2: Introduce the concepts, *grouped and ungrouped data* to learners and ask them to analyse real-life situations where these concepts can be used and why these concepts are important.

Activity 3: Put learners in convenient groups. Go through the worked example on pages 264 and 265 of the Learner's Book with the class.

Activity 4: Assign groups sample data to organise it as a grouped data and ungrouped data and give reasons for their answers.

Ask groups to present their notes to the class. Where necessary, ask them to justify a particular result.

Activity 5: Tell learners to discuss in their groups the differences between grouped and ungrouped data.

Ask groups to take turns to present their work for a class discussions.

Wrap up on each presentation by offering the class the opportunity to ask questions or make suggestions and add information that learners missed.

Review exercise

Differentiated lessons

Remedial activity

Organise data as a grouped and ungrouped.

Challenging activity

Organise data as a grouped and ungrouped and outline the differences between the two concepts.

Assessment tasks ----- LB page 266

Refer learners to page 266 of the Learner's Book for the questions.

Main idea 3

Pictographs

LB page 266

Activity 1: Review the concepts grouped and ungrouped data in a frequency distribution table with learners.

Activity 2: Lead a class discussion about pictographs from primary school to Basic 8. Take them through Main idea 3 on page 266 and the worked examples on pages 266 to 268 of the Learner's Book.

Activity 3: Put learners in convenient groups. Tell groups to use their data in their ungrouped frequency distribution table from the previous lesson and to draw a pictograph.

Activity 4: Allow groups ample time to present their graphs and explain the features of their pictographs. Allow learners to share their work with another group and discuss the difficulties they experienced.

Activity 5: Ask groups to discuss their graphs and ask the rest of the class if there is something they do not understand.

Activity 6: Ask learners to work in groups of four and write their own examples and draw a pictograph that represents the data. Ask groups to set at least two questions about their pictographs for others to interpret and answer.

Review exercise

Differentiated lessons

Remedial activity

Draw a pictograph to represent given data.

Interpret a given pictograph.

Challenging activity

Write a set of data and draw a pictograph to represent the data.

Interpret a given pictograph.

Assessment tasks ----- LB pages 269–271

Refer learners to three sets of questions on pages 261 to of the Learner's Book for the questions.

Main idea 4

Pie charts or circle graphs

LB page 271

Activity 1: Review frequency distribution tables and pictographs with learners.

Activity 2: Lead a brainstorm ideas with the class and ask them to for ideas about when to use pie charts to represent data. Discuss Main idea 4 on page 271 of the Learner's Book.

Activity 3: Put learners into convenient groups (preferably, use their groups from previous lessons). Work through the worked example on pages 272 and 273 of the Learner's Book with the class. Please take time to explain and guide learners through the steps outlined in the Learner's Book to determine the sectors for a pie chart.

Activity 4: Ask learners to solve more examples in their groups. Allow groups ample time to present their charts.

Activity 5: Ask learners in groups to interpret the pie chart on pages 274 and 275 of the Learner's Book. Lead a whole class discussion about the pie chart. Ask the class if there is something that they do not understand well.

Activity 6: Ask learners to work in groups of four and write an example and draw the pie chart for the situation.

Review exercise

Differentiated lessons

Remedial activity

Draw a pie chart for given data.

Interpret a given pie chart.

Challenging activity

Write a set of data and draw a pie chart to represent the data;

Interpret a given pie chart.

Assessment tasks ----- LB pages 275–277

Refer learners to pages 275 to 277 of the Learner's Book for the questions.

Main idea 5

Bar charts

LB page 278

Activity 1: Review frequency distribution tables and drawing pictographs and pie charts with learners.

Activity 2: Lead the class to brainstorm and represent their ideas on a bar chart. You can go through Main idea 5 on page 278 of the Learner's Book with them.

Activity 3: Put learners into convenient groups (preferably, the same groups as for the previous lesson). Ask them to use the data in their frequency distribution table from the previous lesson to draw a bar graph.

Activity 4: Allow groups ample time to present their graphs to the class and explain the features of the bar graph and the bars.

Activity 5: Go through the worked examples on pages 278 to 280 of the Learner's Book with learners. Allow learners to discuss any difficulties they experienced with classmates.

Discuss the example and ask questions to help you find out if some learners do not understand well how to use bar graphs.

Activity 6: Ask learners to work in fours, write their own examples and draw the bar graph to represent their data.

Review exercise

Differentiated lessons

Remedial activity

Draw a bar graph to represent a given data set.

Interpret a given bar graph.

Challenging activity

Write examples of data and draw a bar graph that represents the data.

Interpret a given bar graph.

Assessment tasks ----- LB pages 281–284

Refer learners to pages 281 to 284 of the Learner's Book for the questions.

Main idea 6

Histogram

LB pages 284–285

Activity 1: Review how to draw bar charts with learners.

Activity 2: Lead a class discussion about histograms. Discuss on the features of histograms with the whole class..

Activity 3: Take learners through the steps in the Learners' Book to follow to draw a histogram. Refer to Main idea 5 on pages 284 and 285 of the Learner's Book.

Activity 4: Put learners into convenient groups. Discuss worked examples on pages 285–289 of the Learner's Book with the class. Allow groups ample time to present their graphs when discussing the features of histograms..

Activity 5: Give groups another example from the Learner's Book to work through. Allow learners to discuss anything they do not understand well with classmates.

Activity 6: Asks learners to discuss similarities and differences between bar charts and histograms.

Activity 7: Ask learners to work in pairs, think of an example of data and draw the histogram for the data set.

Review exercise

Differentiated lessons

Remedial activity

Draw a histogram for a given data set.

Challenging activity

Write an example of a data set and draw a histogram that represents the data.

Assessment tasks ----- LB pages 290–293

Refer learners to pages 290 to 293 of the Learner's Book for the questions.

Activity 1: Assess learners' understanding of data collection methods and the features of questionnaires.

Activity 2: Lead a whole class discussion of the meaning of biases and examples of situations in real-life where biases occur.

Activity 3: Present an example from the Learner's Book on biases that are the result of the use of language. Refer to the example in the main idea on page 293 of the Learner's Book. Lead the class to discuss how these biases affect the results we obtain when collecting data.

Activity 4: Put learners in convenient groups. Assign each group an example of a bias that results from ethics on page 294 of the Learner's Book to work on. Allow groups ample time to present their work to the whole class.

Activity 5: Assign biases in relation to gender to learners to do individually. Refer to page 294 of the Learner's Book. Ask learners to work in pairs and share their notes.

Activity 6: Wrap up on the lesson by summarising the main ideas of the lesson.

Review exercise

Differentiated lessons

Remedial activity

Provide a better alternative to a biased question or item on a given survey questionnaire.

Challenging activity

Identify a biased question or item on a survey questionnaire and provide a better alternative for the item.

Assessment tasks ----- LB page 296

Refer learners to page 296 of the Learner's Book for the questions.

Answers to Assessment tasks

Main idea 1

(LB pages 261–264)

Project work 1

Check learners' answers.

Main idea 2

(LB page 266)

Marks	Tally	Frequency
1–20	II	7
2–40	I	11
41–60	I	5
61–80		4
8–100		3
Total		30

Main idea 3

(LB pages 269–271)

1. a. Monday: 20, Tuesday: 10, Wednesday: 15
Thursday: 25, Friday: 40, Saturday: 5

b. Friday

2. a. i. Auto-rickshaw: 45

ii. Car: 30

iii. Bicycle: 55































iv. Bus: 70

v. On foot: 25

b. Mode: Bus

3.

Names of children	Number of cupcakes
Terry	       
Rachel	         
Shelly	     
Nancy	   
Sharon	 

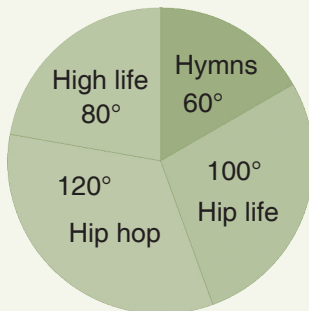
Names of children	Number of cupcakes
Terry	       
Rachel	         
Shelly	     
Nancy	   
Sharon	 

Main idea 4

(LB pages 275–277)

1.

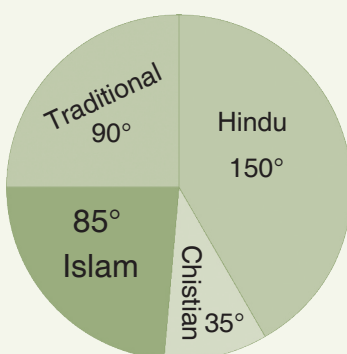
Types of music	Number of learners	Angle of sector
High life	20	$\frac{20}{90} \times 360^\circ = 80^\circ$
Hymns	15	$\frac{15}{90} \times 360^\circ = 60^\circ$
Hip life	25	$\frac{25}{90} \times 360^\circ = 100^\circ$
Hip hop	30	$\frac{30}{90} \times 360^\circ = 120^\circ$
Total	90	360°



b. $\frac{15}{90} = \frac{1}{6}$

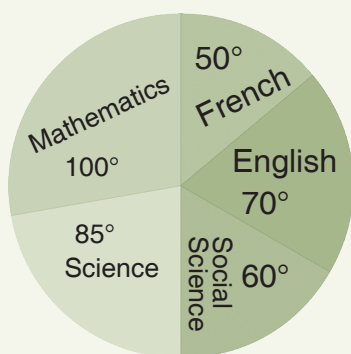
2.

Religion	Number of workers	Angle of sector
Hindu	450	$\frac{450}{1,080} \times 360^\circ = 150^\circ$
Traditional	270	$\frac{270}{1,080} \times 360^\circ = 90^\circ$
Islam	255	$\frac{255}{1,080} \times 360^\circ = 85^\circ$
Christian	105	$\frac{105}{1,080} \times 360^\circ = 35^\circ$
Total	1,080	360°



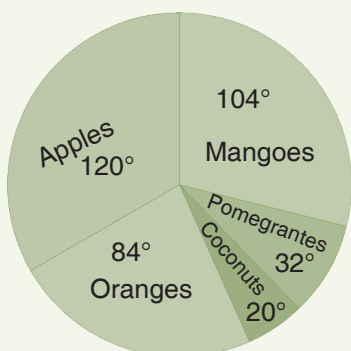
3.

Subject	Marks	Angle of Sector
English	105	$\frac{105}{540} \times 360^\circ = 70^\circ$
French	75	$\frac{75}{540} \times 360^\circ = 50^\circ$
Mathematic	150	$\frac{150}{540} \times 360^\circ = 100^\circ$
Science	120	$\frac{120}{540} \times 360^\circ = 80^\circ$
Social Studies	90	$\frac{90}{540} \times 360^\circ = 60^\circ$
Total	540	360°



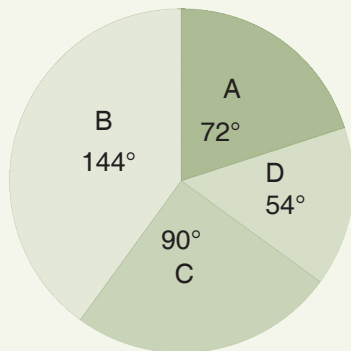
4.

Types of fruits	Number	Angle of sector
Mangoes	26	$\frac{26}{90} \times 360^\circ = 104^\circ$
Apples	30	$\frac{30}{90} \times 360^\circ = 120^\circ$
Oranges	21	$\frac{21}{90} \times 360^\circ = 84^\circ$
Coconuts	5	$\frac{5}{90} \times 360^\circ = 20^\circ$
Pomegranates	8	$\frac{8}{90} \times 360^\circ = 32^\circ$
Total	90	360°



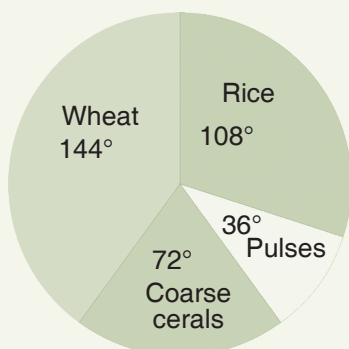
5.

Brand	Percentage of buyers	Angle of sector
A	20%	$\frac{20}{90} \times 360^\circ = 72^\circ$
B	40%	$\frac{40}{90} \times 360^\circ = 144^\circ$
C	25%	$\frac{25}{90} \times 360^\circ = 90^\circ$
D	15%	$\frac{15}{90} \times 360^\circ = 54^\circ$
Total	100%	360°



6.

Food grain	Production (million of tonnes)	Angle of sector
Rice	57	$\frac{20}{90} \times 360^\circ = 108^\circ$
Wheat	76	$\frac{40}{90} \times 360^\circ = 144^\circ$
Coarse Cereals	38	$\frac{25}{90} \times 360^\circ = 72^\circ$
Pulses	19	$\frac{15}{90} \times 360^\circ = 36^\circ$
Total	190	360°



7. a. 120°

b. 48.61 hectares

c. $\frac{1}{4}$

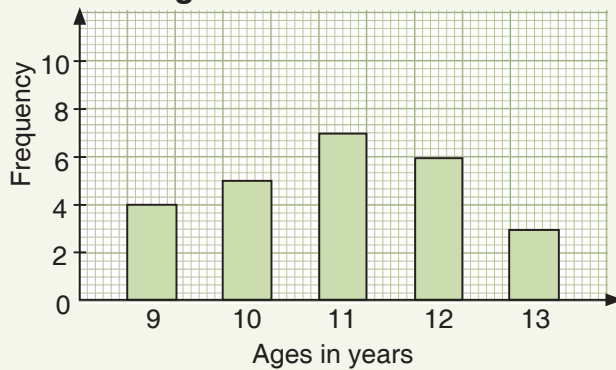
Main idea 5

(LB pages 281–284)

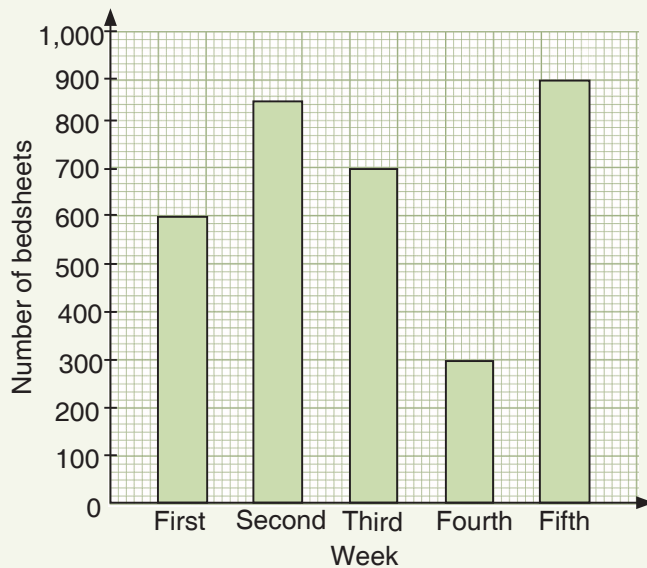
1.

Ages (in years)	Tally	Frequency
9	IIII	4
10	HHH	5
11	HHH II	7
12	HHH I	6
13	III	3

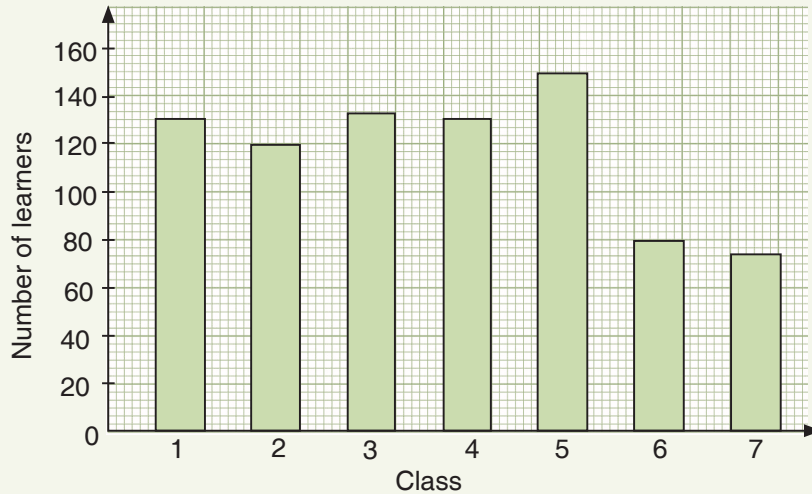
Ages of 25 learners



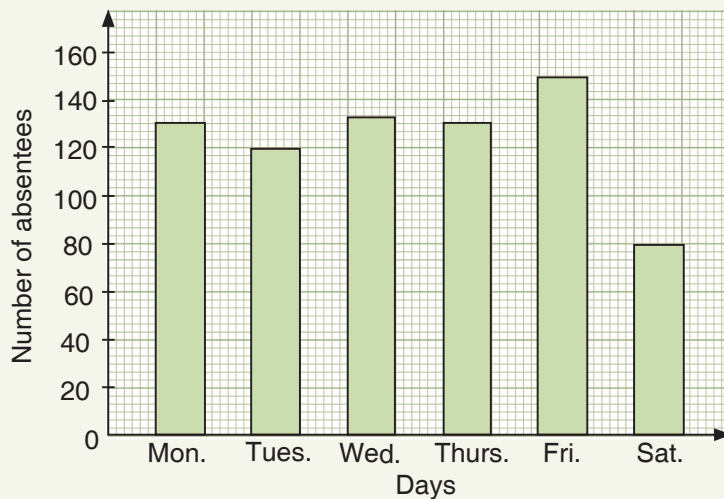
2. Number of bedsheets manufactured a factory



3. Numbers of learners in different classes

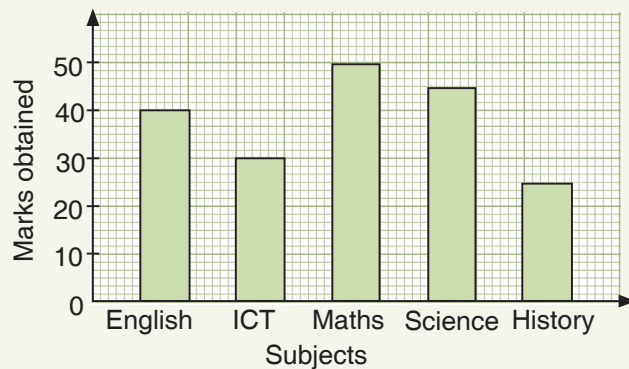


4. Numbers of absentees in JHS 1 in a particular week

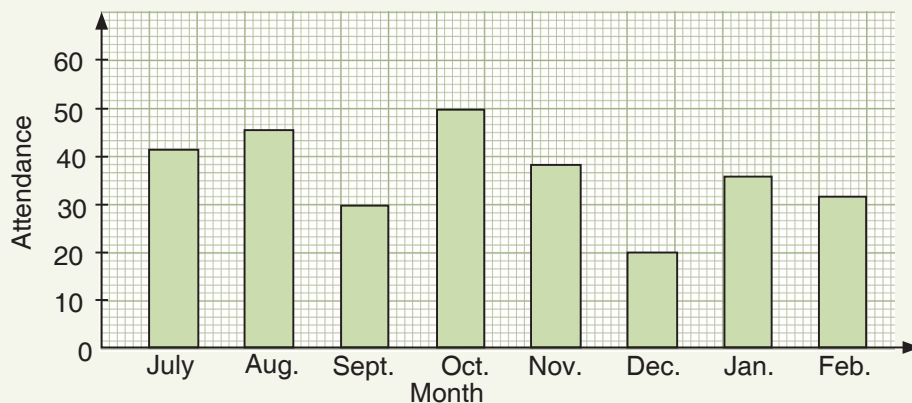


- a. Most learners were absent on Friday. The fewest absentees were recorded on Saturday.
- b. 135 learners were absent on Wednesday and 150 learners were absent on Friday.

5. Fosua's examination marks out of 50 in five subjects



6. a. Monthly attendance of learners in a class



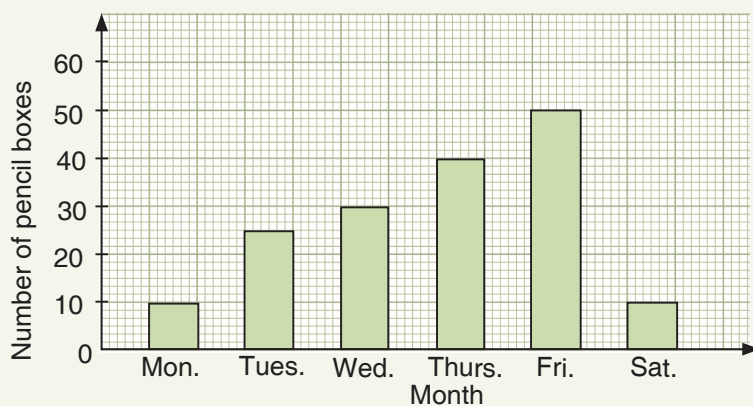
b. Lowest attendance: December;

Highest attendance: October

c. September, November, December, January and February

d. 30

7. a. Sales of pencil boxes in a shop



b. Thursday

c. Minimum loss of sales: Saturday

Maximum loss of sales: Friday

8. a. 6 **b.** 6 **c.** 5 **d.** 25 **e.** 16

9. a. 16 **b.** 3 **c.** Art **d.** 3

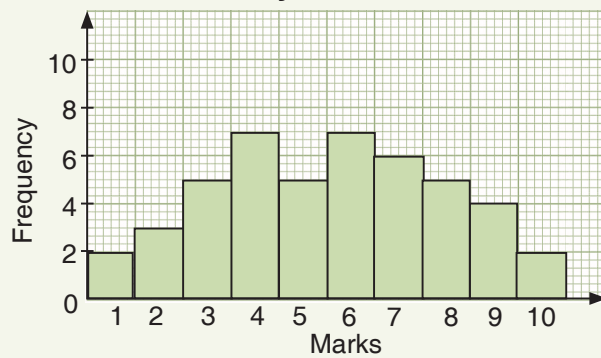
f.

Subject	Art	Maths	Science	English
Number of learners	0	3	8	5

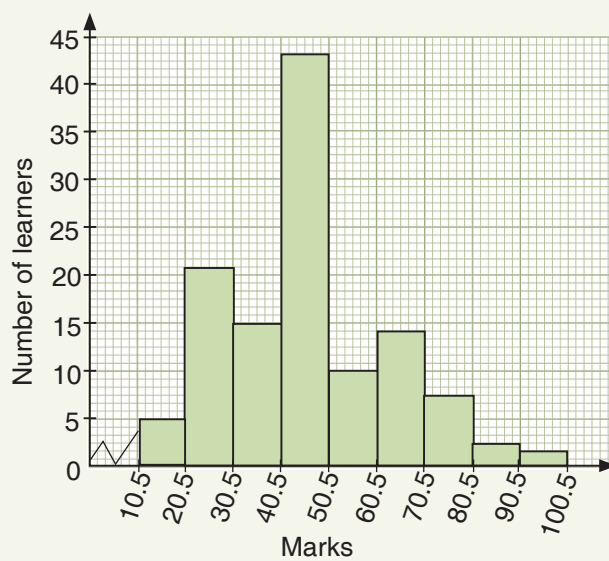
Main idea 6

(LB pages 290–293)

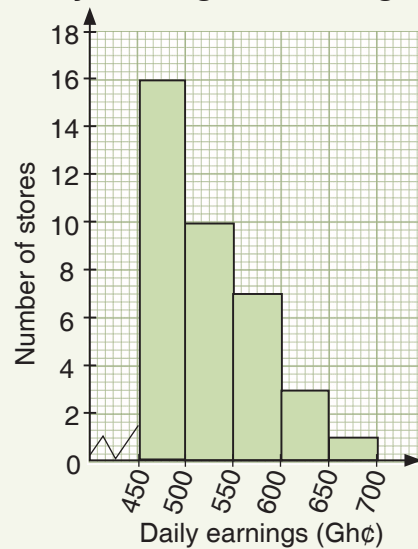
1. Marks obtained by 45 learners in a mathematics test



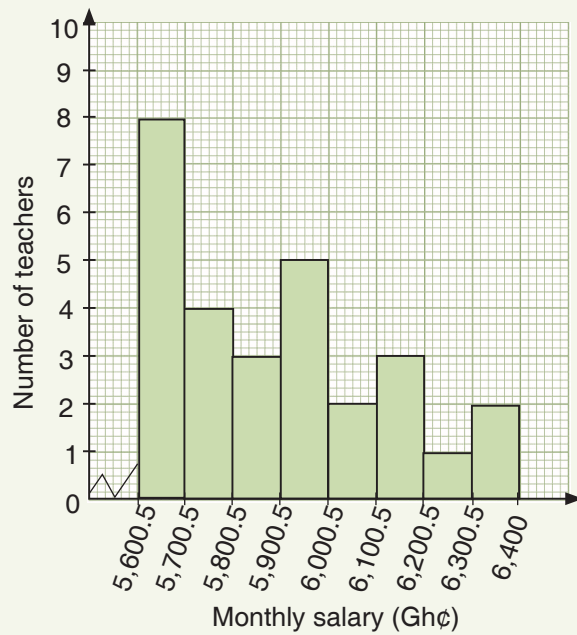
2. Distribution of learners' marks for an examination



3. Daily earnings of 30 drug stores



4. Distribution of teachers' monthly salaries



5.
 - a. 1 –20
 - b. 5
 - c. 300
 - d. 10–15
6.
 - a. GH¢(950 – 1,000); 8 workers.
 - b. GH¢900 – GH¢950; 2 workers
 - c. 40 workers
7.
 - a. 10 learners
 - b. 10
8.
 - a. 2 teachers
 - b. 1 teacher
 - c. Most teachers: 35–40 years old
Fewest teachers: 50–55 years old

Main idea 7

(LB page 296)

Check learners' answers.

Sub-strand 1: Data

Module 2

Measures of central tendency and range

Content standard

B9.4.1.2 Select, justify, and use appropriate methods of collecting data (quantitative and qualitative), organise and analyse the data (grouped/ungrouped) to interpret the results using the descriptive statistics (measures of central tendency and range).

Indicator

B9 4.1.2.2 Organise and analyse data and interpret the result using the descriptive statistic (i.e. minimum, maximum, measures of central tendency and range) to answer a given question.

B9.4.1.2.3 Demonstrate the effect on the mean, median and mode when extreme data is included in a data set.

Learning expectations: In this module, learners will learn how to:

- Use data to find minimum and maximum values, measures of central tendency (mean, median and mode) and range.
- Recognise and explain the effect of an extreme value included in a given data set.

Essential for learning: Learners can:

- Collect and record information using questionnaires and interview guides.
- Organise data into a frequency table, draw simple bar graphs and pie charts.

Resources: Pencils, notebooks, graph sheets

Keywords: frequency, central tendency, mean, median, mode

Competencies: Critical thinking and problem solving, creativity and innovation, communication and collaboration, personal development and leadership.

Starter: Refer to Learner's Book pages 297 and 298. Allow learners to work in pairs and discuss their understanding of measures of central tendency and range.

Main idea 1

Determining range, mode, median and mean

LB pages 298–299

Activity 1: Using think-pair-square, task learners to discuss and write short notes about what they remember about mode, mean and median from their 7.

Activity 2: Learners should also discuss grouped and ungrouped data. Ask a few groups to present their findings to the class.

Activity 3: Lead a whole class discussion on the meaning of the concepts mode, median and mean.

Note: take time to address any misconception that may arise from learners' presentations and contributions.

Activity 4: Engage learners to solve the worked examples on range, mode, median and mean for raw unorganised data on page 300 of the Learner's Book. Go round to offer help and address any challenges.

Tell high ability learners to create their own examples and work out the answers.

Activity 5: Give some more examples on page 300 of the learner's book, this time for learners to work on their own to solve.

Activity 6: Put learners into convenient mixed-ability groups. Go through the worked examples on pages 301 to 304 of the Learner's Book with them to find the mode, median and mean of organised data.

Listen to groups as they discuss examples and solutions and correct learners' understanding as necessary.

Activity 7: Now, assign groups another example about grouped data. Visit groups and note any misunderstandings or mistakes you need to address in a final class discussion.

Reflection

Ask learners to talk about what they have learnt about the mode and the median. Allow them to ask questions for clarification and take the opportunity to address any misconceptions and misunderstandings.

Review exercise

Differentiated lessons

Remedial activity

Determine the range, mode, median and mean of at least 20 items in a data set.

Challenging activity

Determine the range, mode, median and mean with at least 40 items in a data set.

Assessment tasks ----- LB pages 304–305

Refer learners to pages 304 to 305 of the Learner's Book for the questions.

Main idea 2

The effect of an extreme data on a given data set

LB pages 306–307

Activity 1: Assess how well learners remember how to calculate the mean, median, mode and range for a given data set.

Activity 2: Ask learners to work in groups of two or four and to solve a problem on range, mode, median and mean for a given set of data that includes an extreme value. See the example in Main idea 2 on page 306 of the Learner's Book.

Activity 3: Use questioning to help learners think about how the extreme value affects the range and the three averages.

Activity 4: Help the class to conclude that the extreme value has no effect on the mode and median, however, an extreme value affects the mean and range.

Activity 5: Go through the example on page 307 of the Learner's Book with the learners. Help learners to confirm the assertion that an extreme value in a given data set affects the range and the mean.

Activity 6: Give one more example for learners to work on their own to solve. Go round and offer support especially to learners who struggle with data handling.

Note any more misunderstandings or mistakes you need to include in the final class discussion as you wrap up the concepts.

Review exercise

Differentiated lessons

Remedial activity

Calculate the range, mode, median and mean of a given data that includes an extreme data item and draw conclusions about how that effects the range and the three averages.

Challenging activity

Calculate the range, mode, median and mean of a given data with an extreme data and make conclusions, with reasons, on how that effects the range and the measures of central tendency.

Assessment tasks ----- LB page 308

Refer learners to page 308 of the Learner's Book for the questions.

Answers to Assessment tasks

Main idea 1

(LB pages 304–305)

1. **a.** 3 years **b.** 8 years **c.** 5 years
d. 5 years **e.** 3 years **f.** 5

2.

Marks	Tally	Frequency
0	II	2
1	III	3
2	IIII	4
3	III	3
4	I	1
5	IIII	4
6	II	2
7	III	8
8	III	3
Total		30

Mode: 7

Median: 5

Mean: 4.53

3.

Scores	Tally	Frequency
11	III	3
14	I	6
17	III	8
20	II	7
Total		24

Mean: 16.38

Mode: 17

Median: 17

4. Modal group: 8 – 11

Mean: 9.5

5. **a.** 50
b. Median class: 21 – 30
c. Modal class: 21 – 30

Main idea 2

(LB page 308)

1. **a.** Mode: 10; Median: 11; range: 20; Mean: 12.45
b. Extreme value: 30
 The extreme value affects the range.
2. **a.** Range: 369; Mean: 60
b. The extreme value: 374.

Answers to Revision 11

(LB pages 309–310)

1.

Height (in inches)	Frequency
60–64	3
65–69	5
70–74	2

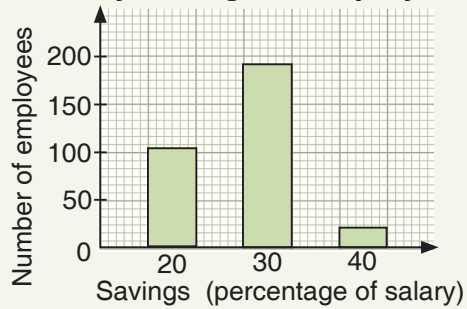
2.

Lengths (mm) of seedlings	Tally	Frequency
150–154	+++	5
155–159		2
160–164	+++	6
165–169	+++	8
170–174	+++	9
175–179	+++ +++	11
180–184	+++	6
185–189		3

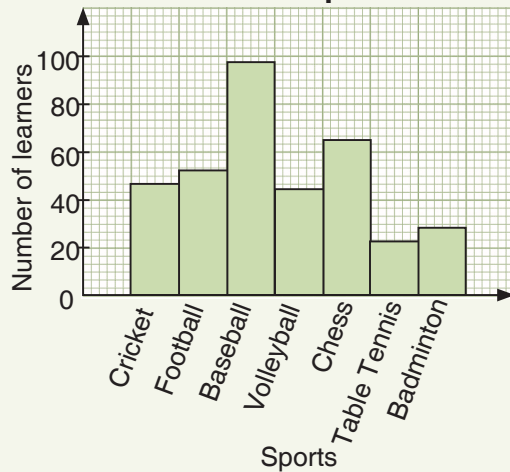
3.

Marks	Tally	Frequency
1–20	+++	7
21–40	+++ +++	11
41–60	+++	5
61–80		4
81–100		3

4. Monthly savings of employees in a company



5. a. Learners' favourite sports



- b.** Range: 77
- c.** Basketball
- d.** Cricket and volleyball
- e.** Table tennis, badminton, volleyball, cricket, football, chess and basketball

Sub-strand 2: Chance or probability

Module 1

Probability

Content standard

B9..4.2.1.1 Identify the sample space for a probability experiment involving two dependent events and express the probabilities of given events as fractions, decimals, percentages and/or ratios to solve problems.

Indicator

B9.4.2.1.1 Identify simple space for a probability experiment involving two dependent events and express the probabilities of a given event as fractions, decimals, percentages and/or ratios to solve problems.

Learning expectations: In this module, learners will learn how to:

- Define probability
- Understand the meaning of probability and the terms associated with it.
- Find the probability of an event in a simple experiment
- Find the probability of an event in a compound experiment.
- Use probability distribution to solve problems.
- Use relative frequency to solve problems given data.

Essential for learning: Learners can:

- Predict certain events that occur around them.
- Be familiar with the dice and coin.
- Determine the probability of given events.

Resources: Pencils, notebooks, coins, dice

Keywords: simple, probability, compound, experiment, distribution, relative frequency

Competencies: Critical thinking and problem solving, communication and collaboration and personal development and leadership

Starter: Refer to Learner's Book pages 311 and 312 and give learners to class time to carry out the colourful marbles experiment. The aim of the activity is to encourage critical thinking.

Main idea 1

Probability of dependent events

LB pages 312–314

Activity 1: Review identifying events as being dependent or independent with learners.

Activity 2: Lead a class discussion about probability concepts such as equally likely outcomes, sample space, event and experiment with examples from Learner's Book.

Activity 3: Ask learners to work in groups. Take them through some of the worked examples on page 315 of the Learner's Book to determine the probability of dependent events. Refer to the worked examples on pages 316 and 317.

Discuss learners' examples and deal with any difficulties that they may have.

Activity 4: Ask learners to work on their own or in pairs and to go through more worked examples from the Learner's Book. Go round and offer support particularly to learners who do not understand the concepts well.

Take note of difficulties or mistakes that you will need to address.

Review exercise

Differentiated lessons

Remedial activity

Calculate the probability of given of dependent events.

Challenging activity

Create problems on probability and solve the problems.

Assessment tasks ----- LB pages 320– 323

Refer learners to pages 320 to 323 of the Learner's Book for the questions.

Main idea 2

Tree diagrams

LB pages 317–320

Activity 1: Review how to calculate dependent probability with learners.

Activity 2: Demonstrate how to calculate the probability of dependent events using tree diagrams.

Activity 3: Put learners into groups and take them through the process in Main idea 2 on pages 317 and 318 of the Learner's Book.

Activity 4: Go through some examples under Main idea 2 on pages 318 to 320 of the Learner's Book with the class to determine the probability of events using tree diagrams.

Discuss learners' experiences and deal with any difficulties that they may have.

Activity 5: Ask learners to work on their own or in pairs and to solve some more examples from the Learner's Book.

Go round and offer support particularly to learners who do not understand the concepts well.

Take note of difficulties or mistakes that you will need to address.

Review exercise

Differentiated lessons

Remedial activity

Calculate the probability of given of dependent events using tree diagrams.

Challenging activity

Create problems that include the probability of dependent events and solve the problems using tree diagrams.

Assessment tasks ----- LB pages 320–323

Refer learners to pages 320 to 323 of the Learner's Book for the questions.

Answers to Assessment tasks

Main idea 1

(LB pages 320–323)

1.
 - a. Probability (2 tails) = $\frac{1}{4}$
 - b. Probability (2 heads) = $\frac{1}{4}$
 - c. Probability (at least heads) = $\frac{3}{4}$
 - d. Probability (at least one tails) = $\frac{3}{4}$
2.
 - a. Probability (picking a red pencil) = $\frac{1}{2}$
 - b. Probability (picking a blue pencil) = $\frac{3}{8}$
 - c. Probability (picking a green pencil) = $\frac{1}{8}$
 - d. Probability (picking a pencil not blue) = $\frac{5}{8}$
 - e. Probability (picking a blue or green pencil) = $\frac{1}{2}$
 - f. Probability (picking red and green pencil) = 0
 - g. Probability (picking a pencil not red) = $\frac{1}{2}$
 - h. Probability (picking a pencil not green) = $\frac{7}{8}$
3.
 - a.
 - i. Probability (2 even numbers) = $\frac{1}{4}$
 - ii. Probability (2 composite numbers) = $\frac{1}{9}$
 - iii. Probability (2 odd numbers) = $\frac{1}{4}$
4.
 - a. Probability (one heads and a six) = $\frac{1}{12}$
Probability (tails and a two) = $\frac{1}{12}$

5. a. Probability (a composite number) = $\frac{1}{3}$
 b. Probability ($x \leq 4$) = $\frac{2}{3}$
 c. Probability (a prime number) = $\frac{1}{2}$
 d. Probability ($x \geq 4$) = $\frac{1}{2}$
 e. Probability (an even number) = $\frac{1}{2}$
6. a. 35 learners
 b. i. Probability (the highest mark) = $\frac{1}{35}$
 ii. Probability (the lowest mark) = $\frac{2}{35}$
 iii. Probability (6 marks) = $\frac{2}{7}$
 iv. Probability (fewer than 5 marks) = $\frac{8}{35}$
 v. Probability (more than 5 marks) = $\frac{23}{35}$
7. a. 619 learners
 b. i. Probability (learner in St Augustine) = $\frac{162}{619}$
 ii. Probability (learner in St Joseph or Blessed Anne-Marie) = $\frac{307}{619}$
 iii. Probability (learner in St Leo) = $\frac{150}{619}$
8. a. 0.42 or 42%
 b. 0.5 or 50%
 c. 0.46 or 46%

Answers to Revision 12

(LB page 324 - 325)

1. a. $\frac{1}{4}$
 b. $\frac{9}{20}$
2. Sample space {HH, HT, TH, TT}
2. a. $\frac{1}{4}$ b. $\frac{1}{4}$ c. $\frac{3}{4}$ d. $\frac{3}{4}$
3. a. $\frac{1}{4}$ b. $\frac{1}{2}$ c. $\frac{5}{12}$
4. a. $\frac{6}{13}$ b. $\frac{5}{13}$ c. $\frac{2}{13}$ d. $\frac{8}{13}$
 e. $\frac{7}{13}$ f. 0 g. $\frac{7}{13}$ h. $\frac{11}{13}$

5. a. 40 learners

b. i. $\frac{3}{40}$

ii. $\frac{1}{40}$

iii. $\frac{4}{40}$

iv. $\frac{13}{20}$

v. $\frac{19}{20}$

6. $\frac{8}{21}$

7. $\frac{4}{5}$

8. $\frac{1}{5}$

ESSENTIAL

Mathematics

Basic 9

Facilitator's Guide

ESSENTIAL **Mathematics** is an engaging and comprehensive course in Mathematics. The material has been developed to meet the full requirements of the Common Core curriculum for JHS, as developed by the National Council for Curriculum and Assessment (NaCCA). It offers accessible, high – quality content to lay a sound foundation for further studies in the subject.

ESSENTIAL **Mathematics** is written in a clear and concise manner, ensuring that learners grasp the fundamentals with ease, equipping them with the needed skills, knowledge, and confidence.

The **ESSENTIAL** **Mathematics Basic 9 Learner's Book** emphasizes conceptual understanding through real-life examples and relatable scenarios fostering a deeper appreciation for the practical applications of mathematics. Offering:

- a variety of exercises, ranging from basic practice problems to challenging application tasks, allowing students to develop their problem-solving skills progressively
- interactive and collaborative learning opportunities through its beautifully designed diagrams and illustrations to reinforce key concepts and promote active engagement with the material
- activities that foster teamwork, critical thinking, and communication skills, etc.

The **ESSENTIAL** **Mathematics Basic 9 Facilitator's Guide** supports the facilitator to teach the new curriculum with confidence and offers:

- detailed guidance on how to effectively cover the required topics, ensuring that teachers have a strong foundation to create well-structured lesson plans
- guidance on effective classroom management strategies to create a positive and inclusive learning environment
- regular assessments and review sections to monitor learners progress and reinforce learning
- answers to assessments in the Learner's Book

Learning is Essential!



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